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RESEARCH

UNITED STATES DEPARTMENT OF AGRICULTURE

FOREST SERVICE

In cooperation with

BUREAU OF PLANT INDUSTRY

Report of the

ALLEGHENY FOREST EXPERIMENT STATION*

January 1 to December 31, 1935

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PROJECT RECORDS*

*The project record sheets, which give for each project separately a brief summary of its aims, history, current and future work, together virtually constitute the Station's research program. Attached to the Annual Report as an Appendix, they have been left unnumbered.

EXPERIMENTAL FORESTS AND OTHER CENTERS OF FIELD WORK
OF THE
ALLEGHENY FOREST EXPERIMENT STATION±

(a) Branch Stations - Established

Name and Location	Area in acres	How and When Acquired	Improvements	Sample Plots					
				Permanent			Semi-permanent		
				No.	Size, acres	Use	No.	Size, acres	Use
Camp Ockan-X ickon, Medford, New Jersey	340	By agreement with the trustees of Camp Ockanickon Inc., dated March 15, 1928	1 - Field house-laboratory, 1929 1 - Tool house, 1929	14 5 1	1/10 1/2 1	Oak yield studies Effects of stand improvements cuttings	2	2	Growth-yield studies (Formerly fire plots)
				-	40	Interplanting of irregular areas	441	1/10	Stand inventory cruise and ecological description 1928-9
Kane, Near Kane, Pa., in Allegheny National Forest, Jones Twp., Elk County	1736.8	Designated by the Forester as an experimental area under Regulation L-20, March 23, 1932	1 - Ranger's house, 1931 1 - laboratory-messhall, 1931 2 - Staff dwellings, 1932 1 - Garage-workshop, 1932 1 - Parking shed, 1934 1 - 50' weather observation tower, 1933 Wagon trails 12 mi. Truck trails 4.4 mi. Fire lines 5 mi. Telephone line 2 mi. Power line 2.4 mi. Miscell. (elec., gas, water lines, etc.)	15 5 2 1	1/10 1/2 2 4	Permanent yield of northern hardwoods Influence of deer and rabbits on reproduction Effects of stand improvement cuttings			

Name and Location	Area in acres	How and When Acquired	Improvements	Sample Plots					
				Permanent			Semi-permanent		
				No.	Size, acres	Use	No.	Size, acres	Use
Lebanon [x] New Lisbon, New Jersey	546	Leased from New Jersey Board of Conservation and Development, January 30, 1934	1 - Dwelling-laboratory, 1934 1 - Garage-workshop, 1934 Safety strips, 4 mi. Truck trails, 3 mi. Wagon trail, 1 mi. 1 - Telephone line 1 - Power line Water and sewerage system	16	1/16	Conversion to high forest and stand improvement	67	1/10	Strip survey plots, used for yield study

x Note: In 1934 most of the activities at Camp Ockanicken were transferred to the Lebanon branch.

(b) Branch Stations - Proposed

Location	Estimated Area Acres	Forest type	Method of Acquisition	Remarks
*Beltsville, Md.	2000	Oak-pine	Through Resettlement Administration	Part of National Agr. Research Center
*Stone Valley, Pa.	1800	Oak-chestnut-yellow poplar	" " "	
Eastern Shore, Md.	1400	Oak-pine	" " "	Chiefly loblolly pine
Northern New Jersey	-	Oak-chestnut-yellow poplar	Future. To be determined	Municipal watershed
Anthracite Coal Region	-	" " " "	" " " "	
Bituminous Coal Region	-	" " " "	" " " "	
North Central Penna.	-	Birch-beech-maple-hemlock	" " " "	Glaciated part of State

* In course of acquisition; development started

(c) Other Centers of Field Work+

Name and Location	Area in acres	How and When Acquired	Sample Plots: Permanent No.	Permanent Size, acres	Permanent Use	Semi-permanent No.	Semi-permanent Size, acres	Semi-permanent Use
Heart's Content Natural Area. In Allegheny National Forest, Pa.-Limestone Township, Warren County	121	20 acres donated to Fed. Govt. by Wheeler-Dusenbury Lumber Co., March 31, 1928; 101 acres purchased by U.S.D.A. in 1928	163	1/10	Ecological studies 1928-30			
Little Arnot Creek. In Allegheny National Forest, Mead Township, Warren County	20	Experimental plots taken over from Allegheny National Forest in February, 1928	4	1 each in center 5-acre area	Reproduction cuttings in a 60-year old stand of mixed hardwoods. 1928 et seq.			
No specific names. In Allegheny National Forest, scattered through drainage lower Tionesta Creek	Total area 42 acres	No special agreements made, but consent obtained				10	aver. 4.18	Ecological studies and effects of commercial cutting practice (Natural reproduction) 1928-1929
Tionesta Natural Area (propcsed). In Allegheny National Forest, McKean and Elk Counties	4300	Approval for purchase obtained from National Forest Reservation Commission, Nov. 23, 1934.			None as yet			None as yet
Adjacent to above area. In Allegheny National Forest, McKean and Elk Counties	Indefinite	" " "				651	1/10	Strip inventory cruise and ecological description, 1930
						10	1	Ecological studies of virgin forests, 1934 et seq.

Name and Location	Area in acres	How and When Acquired	Sample Plots					
			Permanent			Semi-permanent		
			No.	Size, acres	Use	No.	Size, acres	Use
No specific names, Eastern Shore of Maryland, Worcester County	About 3.5 acres (1935)	58 plots, covering about 15 acres, were established in 1906; consent obtained from State officials or private owners.				14	Aver. 1/4	Mensuration studies, loblolly pine (oak-pine type) 1906 et seq.
No specific names. Scattered throughout Allegheny National Forest, Central Penna. and Cecil Co., Maryland	About 6	Mostly private land				43	various sizes, from 1/160 to 1/2	Mensuration studies, oaks. Prior to 1930
No specific names. Northern Pennsylvania	Indefinite	Mostly private land				Nearly 200	1/2	Strip plots; ecological studies and effects of commercial cutting, 1929-1930

+ No permanent improvements at any of these centers.

‡

Region

	Acres
Total area	41,121,280
Total forest area [x]	22,489,000 [x]
Number of States	4
Number of National Forests	1

[x] Includes abandoned farm land available for forestry (Copeland Report data)

Membership

ALLEGHENY FOREST RESEARCH ADVISORY COUNCIL

1935

Dr. J. G. Lipman, Agricultural Experiment Station, New Brunswick, New Jersey
Dr. R. H. True, University of Pennsylvania, Philadelphia, Pennsylvania
Charles G. Berwind, Berwind-White Coal Mining Company, Commercial Trust Building, Philadelphia, Pennsylvania
F. W. Besley, State Forester, Baltimore, Maryland
Thomas C. Buchanan, Secretary, Department of Forests and Waters, Harrisburg, Pennsylvania
Egbert S. Cary, Superintendent, Pocono Lake Preserve, Moorestown, New Jersey
Francis R. Cope, Jr., Dimock, Susquehanna County, Pennsylvania
E. O. Ehrhart, Armstrong Forest Company, Johnsonburg, Pennsylvania
Professor J. A. Ferguson, Department of Forestry, State College, Pennsylvania
Dr. O. E. Jennings, Carnegie Museum, Pittsburgh, Pennsylvania
Henry W. Leeds, Chalfonte-Haddon Hall, Atlantic City, New Jersey
Dr. C. A. McCue, Director of Extension, University of Delaware, Newark, Delaware
Adolf Muller, DeKalb Nurseries, Norristown, Pennsylvania
P. G. Platt, President, Pennsylvania Division, Izaak Walton League of America, Wallingford, Pennsylvania
M. B. Saul, 2301-7 Packard Building, Philadelphia, Pennsylvania
Col. Henry W. Shoemaker, McElhattan, Pennsylvania
J. Spencer Smith, 60 Hudson Street, New York City, New York
Ezra B. Whitman, Whitman Requardt & Smith, West Biddle Street at Charles, Baltimore, Maryland
H. C. Wiener, H. C. Wiener Lumber Company, Miners Bank Building, Wilkes-Barre, Pennsylvania
C. P. Wilbor, State Forester, Trenton, New Jersey
Abel Wolman, Maryland State Department of Health, 2411 North Charles Street, Baltimore, Maryland

PERSONNEL ALLEGHENY FOREST EXPERIMENT STATION

1935

PERMANENT STAFF

FOREST SERVICE

Forbes, R. D.	Director	
Schnur, G. L.	Associate Silviculturist	
Hough, A. F.	Assistant Silviculturist	
Wood, O. M.	Assistant Silviculturist	
Ackerman, P. E.	Ranger	
Skamser, Miss C. Eunice	Senior Clerk	Transferred to Central Rocky Mt. F.E.S. 8/3/35
Stiles, Miss Hazel L.	Senior Clerk	Transferred to Allegheny F.E.S. from Lake States F.E.S. 8/3/35
Evans, Mrs. Margaret R.	Senior Stenographer	
Loose, Miss Hazel V.	Assistant Statistical Clerk	

BUREAU OF PLANT INDUSTRY

Jackson, L. W. R.	Assistant Pathologist in Charge
Doak, K. D.	Assistant Pathologist

TEMPORARY EMPLOYEES

FOREST SERVICE

Hazen, J. F.	Junior Forester
Mollenhauer, Wm. Jr.	Junior Forester
Randall, A. G.	Junior Forester
Simmons, E. M.	Junior Forester
Turberville, H. W.	Junior Forester
vanNieukerken, J. M.	Assistant Forester
Broomall, R. P.	Assistant to Technician
Wilkinson, R. M.	Assistant to Technician
Niederhof, C.	Field Assistant
Ogloblin, K. A.	Field Assistant

Luther Maze, Foreman; Hugh Duffy and Bayard Noble, Draftsmen; Miss Rita Armstrong and Miss Sarah Brodsky, Stenographers; Miss Grace Dougherty and Mrs. Minnie Blumenstein, Computing Clerks; Tony Dipoalo, Clerk at Kane Branch Station. In addition 7 laborers were employed for short periods.

BUREAU OF PLANT INDUSTRY

Sleeth, Dr. Bailey	Junior Pathologist
Aaron, Isador	Assistant Scientific Aid
Kaplan, Frank	Assistant Scientific Aid
Wean, Robert	Assistant Scientific Aid

PART I

WORK OF THE CALENDAR YEAR 1935

SUMMARY OF ACCOMPLISHMENTS

ADMINISTRATION

Completion at the Kane Experimental Forest of the much-needed connection between the headquarters buildings and a commercial electric power line at Sergeant, Pennsylvania, and improvement of the Seven Mile road by the CCC. When completed the latter will result in an all-weather road to the Forest headquarters.

Inventory, by the line-plot method, of about 70 per cent of the stand on the Lebanon Experimental Forest.

Development of plans for additional branch stations in Stone Valley, Pennsylvania, and at the National Agricultural Research Center, near Beltsville, Maryland. Acquisition of experimental forests at these points has been sought through the Resettlement Administration.

RESEARCH IN SILVICS*

Mensuration, Oak-Pine (Project ME-3)

Derivation, from some of the oldest permanent sample plots in the United States, of important information on the long-term behavior of even-aged loblolly pine stands in Maryland. The Forest Service established these plots on private land on the Eastern Shore in 1906, and in cooperation with the Maryland Forest Service has re-measured them at 5-year intervals; the seventh measurement was begun by the Allegheny Station late in 1935. The data from the first 25 years' measurements were used during the year in two papers, one bearing on some fundamental aspects of thinning, the other on site classification. Similar basic studies of stand behavior, by forest mensurationists elsewhere in the United States and in Canada, were furthered by data supplied from these plots.

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*For the convenience of those unfamiliar with the previous work done by this Station on the projects which constitute its present program of silvical research, Project Record sheets are attached at the end of this report. For each of the projects these sheets state in brief form the object, the scope, the status on the first day of the calendar year covered (i.e. a synopsis of the work done and the results obtained prior to this date), the accomplishments during the current year, the plans for the ensuing year, the additional facilities and personnel needed, the time when definite results may be expected, and the person or persons under whose immediate direction the project is carried out.

Special Studies, 1930 Drought

Completion of a cooperative study, by Pennsylvania State College and the Allegheny Station, of the effect of drought, particularly the unprecedented drought of 1930, on the oak forests near State College. This will appear as a College bulletin, the second to be prepared jointly by these organizations; the first was in the field of mensuration. The 1930 drought was found to have caused greater mortality among such conifers as pitch pine, mountain pine, white pine, and hemlock than among the associated oaks and other hardwoods. This is hardly less unexpected a finding than that losses were largely independent of the degree of competition to which the trees had been subjected, as expressed by crown class.

The above are the major accomplishments of the year 1935. Work in other projects, all of which are on a long-term basis, did not yield comparably conclusive results within the 12 months. The following account of them therefore records progress rather than accomplishment in the strict sense.

Management, Birch-Beech-Maple-Hemlock (Project M-1)

Progress on an article, for publication in Ecology, entitled "The Virgin Forests of the Northern Allegheny Plateau".

Complete office analysis of the 1934 field data from the 10 plots established to reconstruct the ecological and silvical history of the Tionesta Virgin Forest. This includes total age counts on basal sections from over 5000 trees on 6 plots, and tracing of stem maps for all 10 plots.

Collection in the field of all necessary data from the 4 remaining plots in Tionesta Forest, except sections from large trees to be cut in 1936.

Determination that the 1930 and 1934 droughts, rather than insects or disease, are the cause of the dying of virgin hemlock and beech in Tionesta Forest and private timber near Sheffield.

Beginning of an intensive study of storage and germination of black cherry seed.

Publication of three Technical Notes on the reproduction cutting plots on Little Arnot Creek, further analysis of the records of reproduction and reserved trees, and computation of the volume of the stands, not earlier possible because of lack of volume tables.

Management, Oak-Pine (Project M-3)

Phenological observations, with special emphasis on seed production, of an adequate number of trees of the principal species on the Lebanon Forest, to supplement continuous records of seed production of chestnut oak at Camp Ockanickon.

Observation of the survival and height growth of oak seedlings in 18 beds at the Lebanon Forest, representing a variety of physical conditions.

The first 5-year remeasurement of 4 plots at Camp Ockanickon, established to study sprout behavior and conversion of hardwood coppice to a mixture of high forest and sprouts.

Establishment of sixteen 1/4-acre plots in a 13-year-old stand of oak and pine on the Lebanon Forest, for the same purpose as the preceding. Measurements of the stand on eighty-nine 1/10-acre plots on the Forest, and in CCC cuttings nearby, were taken as a guide in determining 3 degrees of thinning applied to the plots.

Mensuration, Oaks (Project ME-2)

Mimeographing and distribution, by request, of the 45 volume tables included in our Departmental bulletin on "Yield, Stand, and Volume Tables for Even-Aged Upland Oak Forests", still unpublished for lack of funds.

Completion of a study comparing the volume of trees of different species in one locality, and of the same species in different localities.

Interplanting, New Jersey Coastal Plain (Project Fp-3)

Submission for criticism of a manuscript entitled "Survival of Some Pine Interplantings in Southern New Jersey", summarizing the results of the planting done to this time.

Publication of Technical Note No. 4, dealing with some phases of the same subject.

RESEARCH IN FOREST PATHOLOGY

Mycorrhizae (B.P.I. Project 6P)

Secondary Parasitism of Mycorrhizae. A determination by isolation in pure culture that certain mycorrhiza-forming fungi, similarly to non-mycorrhiza-forming ones, have more than one physiological strain which may or may not differ in parasitic behavior. These properties are important in connection with the treatment of nursery soils.

Culture Methods. Extension of the study of nutrient absorption for mycorrhizal and non-mycorrhizal roots by pure culture methods developed especially for this relationship.

Growth Relations. Studies comparing the effect of treatments with organic and inorganic forms of nitrogen on the growth of white and pitch pine together with their more important mycorrhizal fungi; also the influence of moisture and several inorganic nutrients.

Mycorrhizae and Pseudo-mycorrhizae. Determination of the relative effects that different nursery soils and fertilizer treatments may have on the balance of mycorrhizal and pseudo-mycorrhizal development on the root systems of various coniferous seedlings.

Isolation and Classification of Known Species of Fungi. Considerable progress in the preparation of a key enabling the ready identification, by their mycelial characters, of the known mycorrhiza-forming fungi.

Nursery Diseases (B.P.I. Project 2P)

The determination of the hydrogen-ion tolerance of certain damping-off parasitic fungi.

Experiments, carried out simultaneously at 3 forest nurseries in the region, to determine what effect the treatment of the soil with various chemicals has on the control of damping-off and of root rot in coniferous seedlings.

Preparation of acidity maps for several forest nurseries in the Eastern States to aid in the fighting of damping-off.

A study of the fungi causing damping-off and root rot in the Washington Crossing, New Jersey, Parsons, West Virginia, and Mont Alto, Pennsylvania, State nurseries, and the discovery of several hitherto unknown ones.

The development and bringing into actual practice of a new laboratory method for predetermining the amount of aluminum sulphate or sulphuric acid to be added per square foot of soil in order to increase its acidity to any desired degree and depth.

A considerable amount of service work - unfortunately still inadequate because of lack of assistance - for nurseries scattered throughout the United States.

Disease Survey (B.P.I. Project 1P2)

The diagnosis of the severe dying of Norway pine in the plantations on the watershed at York, Pennsylvania, as partly due to drought injury.

General field investigations of numerous inquiries on twig blight among the Austrian pine and of the dying of Himalayan pine in the Philadelphia area.

Continuation of the study of the disease threatening the extermination of the European plane tree (Platanus orientalis) in the western suburbs of Philadelphia, and the discovery that the disease can be transmitted to the native species (P. occidentalis).

Decay of Sprout Hardwoods (B.P.I. Project 3P)

The establishment, as the result of the cutting of six 1/4-acre experimental plots of sprout oaks in various parts of Pennsylvania and the examination of several hundred trees of different ages, of the several factors determining the point of entrance, the distribution, and the transmission of decay in a variety of species of sprout oaks.

A field study and the experimental inoculation of many oaks in Connecticut to determine the cause and distribution of butt rot in oaks.

A cooperative study with Mr. Bradford Bidwell of the Connecticut Forestry Department, of Polyporus hispidus and associated cankers.

A continuation of the Strumella canker studies on the plots at Sand Springs, near State College, Pennsylvania.

A MORE DETAILED ACCOUNT OF THE STATION'S WORK

ADMINISTRATION

Finances

For the fourth successive year the Station has been operated on greatly curtailed "regular" (i.e. continuing) funds. The Forest Service allotment to the Station was $22,843.03 for the fiscal year 1935, and that made at the beginning of the fiscal year 1936, $23,350. These amounts are about three-fourths of those received in 1932. The corresponding allotments to our cooperators, the Office of Plant Pathology, Bureau of Plant Industry, at Philadelphia, were $8,325 and $7,900.

"Emergency" or temporary funds allotted to the Station have been very welcome, although the restrictions placed on their use and above all their uncertain duration have reduced their effectiveness in the type of work on which an experiment station is engaged. In the fiscal years 1935 and 1936 these funds for the Forest Service amounted to $24,200 and $28,900 respectively, permitting the employment, during the calendar year 1935, of 9 technically trained men for an average of 7.6 months, as well as 2 computing clerks, 2 draftsmen, 2 stenographers, and up to 9 laborers for varying periods. The last-named were employed at the branch stations where a number of valuable improvements, later described, were constructed. During the same period 5 technically trained men, employed for an average of 8.4 months, and 1 student, working for a few hours each week, all paid directly from the Washington office of the Bureau of Plant Industry out of emergency funds, aided in the research activities of the local Office of Pathology.

Advisory Council

In July the Council was enlarged and greatly strengthened by the Secretary's appointment of 11 new members, several representative of interests not hitherto on the Council. Nine members attended a successful field meeting at the Kane Branch Station on October 18 and 19.

Branch Stations

Lebanon (southern New Jersey)

Inventory Cruise

Partly as a basis for the establishment of experimental plots to study the possibilities of converting coppice stands into mixed stands of high forest and coppice, a 2 per cent line-plot survey was made early in the summer of about 70 per cent of the Lebanon Experimental Forest. In all 67 one-tenth-acre plots were established and marked with cedar posts so that they can be relocated. The survey data

will supplement the aerial photographs of the tract made in 1926. In addition to stand data, elevations were recorded on each plot and along each strip line so that a topographic map of the tract can be prepared.

Weather Observations

Weather observations were continued at the open station during 1935. Observations at another station, set up in the woods about 300 feet from the open station, were started in April and will be continued.

A paper analyzing and summarizing the precipitation data collected for several years at Camp Ockanickon under various kinds of tree cover was revised, and will shortly be submitted for publication.

Kane (northwestern Pennsylvania)

Improvements and Maintenance

A direct overhead electric connection, entirely on Government land and without crossing railroads or public roads, was made between the Branch headquarters and the West Penn Power Company's 2300-volt transmission line. CCC labor was used in hauling poles and cutting a 66-foot swath through 2.4 miles of forest. Materials and erection labor were provided by ERA.

Several miles of new truck trails were built with CCC labor, and parts of existing roads were regraded or otherwise improved to facilitate fire protection and to make the headquarters more accessible from State roads. The CCC also contributed toward building a three-car parking shed.

With ERA labor a rodent-proof storage room was built over the garage and further storage space was provided by putting in flooring above the toolroom. The Ranger's residence was improved by some landscaping and the building of a native stone fireplace.

All sprout-producing stumps in the 4-1/2-acre planting site were grubbed out, and thirty 4x4 foot seed boxes were constructed, by the CCC. The seed boxes, protected against rodents by removable 1/2-inch screen wire covers, will be used in studies of seed germination.

Inventory Cruise

The field data collected in the strip cruise of the Kane Experimental Forest in 1932, and partially worked up in succeeding years, was summarized and filed in forms for ready use in planning future research on the Forest. The following items have been summarized by age classes, stocking classes, and compartments: acreage, cubic feet per acre, basal area per acre, and species composition by percentage of basal area.

Weather Observations

The meteorological data collected at three weather stations established in July, 1932, and a fourth in October, 1933, were analyzed for use in the manuscript on the virgin forests of the northern Allegheny Plateau. These records, although short, are a valuable indication of the

influence exerted by virgin timber and second growth on local climate; also of the effect of topography (frost pockets, so-called) on local climate.

Proposed Tionesta Natural Area

Steps have been taken to designate as a "Natural Area" all or most of the 4416 acres of timber on East Tionesta Creek, 7 miles west of Kane Forest, purchased from the Central Pennsylvania Lumber Company in 1934. The Station drew up a definite plan of management for the tract, in which it hopes the Regional Forester and the Pennsylvania Forestry Association will concur; this, revised if necessary, will be submitted to the Chief of the Forest Service for approval. The Bureaus of Plant Industry and of Entomology and Plant Quarantine in Washington were consulted on the potentially difficult problems of protecting this invaluable "living museum" against disease and insects.

A map, showing drainage and culture, was compiled and drawn to include the proposed Natural Area, the adjacent virgin forest recently cut over, and neighboring second growth. Another map was prepared by superimposing on this the contours obtained from an enlargement of the topographic map, recently completed, of the U. S. Geological Survey. An outline was prepared of the Area's botanical, zoological, soil, and meteorological problems.

Projected Branch Stations

General

Establishment of suitably distributed branch stations is particularly difficult in the Allegheny territory, because of the lack of federally owned land available for experimental forests. There is only one National Forest in the four States, and three of the States do not even have enabling acts permitting Federal purchase of forest land.

Considerable progress has, nevertheless, been made toward the acquisition of experimental forests and the establishment of branch stations in two of the areas discussed in the 1932-34 report, and preliminary steps have been taken to acquire land in a third of the recommended locations, all through the Resettlement Administration. That Federal agency plans to acquire the lands; put local people to work cleaning them up, constructing trails, roads, firelines, and the simple buildings necessary at branch stations; and finally to turn the property over to the Station for forest research purposes.

Standing Stone Valley (central Pennsylvania)

This experimental area in Huntingdon County includes about 1800 acres in the oak-chestnut-yellow poplar type. Although there are a good many old-field stands of Virginia pine, the forest consists for the most part of a quite compact stand of mixed oak, with some white and pitch pine. There is a good distribution of age classes below 60 years. Elevations run from 800 to 1100 feet above sea level, and there is a great variety of slopes and exposures. One continuous tract of nearly 1000 acres will afford a good opportunity for wildlife studies, provided

we can obtain the necessary cooperation to conduct them. The tract is accessible by paved roads from several small rural communities, and is within 15 miles of some small manufacturing towns and the main line of the Pennsylvania Railroad. Fire protection is comparatively easy because the tract is practically surrounded by farms and is intersected by a network of paved and dirt roads. Although, as a result of the Federal program, the rural population may diminish, it is quite possible that increased use of the tract for intensive research work, increased recreational use of the surrounding public lands, the rapid expansion of the paved road system, will tend rather to increase the population.

During the last few weeks of the year two foresters, ten-percenters on the ERA program, have been working on the Huntingdon tract, helping Mr. Munro, Project Superintendent for the Resettlement Administration, with the development of the area in which we are interested. Preliminary plans are being made for the ERA crew work which will be started early in 1936, as soon as the land becomes definitely available. A building site was selected and a 5-foot interval contour map made of it, on which later also the tentative location of the buildings was indicated. The architectural plans of the lodge - a combination bunkhouse and messhall - were well under way at the end of December.

Between 2 and 3 miles of the outside boundary line of the tract have been surveyed.

National Agricultural Research Center (Maryland)

This Branch is projected as a part of the National Agricultural Research Center at Beltsville. About 1200 acres of land, flanked on two sides by the tracts of the Biological Survey, have been assigned to the Station. Although generally of the oak-pine type, the forest also comprises a number of old-field Virginia pine stands; there is a fair distribution, both in composition and age, of upland oaks, with some bottomland oaks and other hardwoods. Fires have been quite severe in portions of the area, but the intensive development of the Research Center, the presence of CCC camps, and the cordial interest of the Maryland State Department of Forestry, should henceforth greatly simplify the fire problem. The tract is compact, and lies along a paved highway. The prospects of having adequate buildings for this Branch Station are unusually favorable. The architects of the Resettlement Administration have completed the preliminary plans and elevations of the group of buildings proposed by us. They intend not only to use wood throughout but to apply, wherever possible, recommended materials and practices developed by the Forest Products Laboratory at Madison, Wisconsin. Because of its close proximity to Washington, this Branch unquestionably affords a unique opportunity to publicize the methods and, eventually, the results of forest research.

To eliminate a definite fire hazard, the tract is being cleared of debris. Some 50 acres have been cleaned so far by a small ERA crew. A preliminary plan for the physical development of this area was completed.

Eastern Shore (Maryland)

It is hoped that an experimental forest in the oak-pine type of Delaware and the Eastern Shore of Maryland may be procured. The Resettlement Administration has obtained an option on about 8000 acres of submarginal farmland and adjacent woodland in Worcester County, Maryland, and purchase is under way. The Maryland State Forestry Department is well disposed toward the Station receiving a part of this, and will give it a reasonably free hand in selecting the tract. The balance would be taken over as State Forest land. The State already owns some forest land in the vicinity.

Although a hasty examination of a portion of the area has been made by representatives of both the Station and the Washington Office, the selection of a suitable tract and its development are seriously handicapped by the Station's lack of technically-trained personnel.

This proposed branch station would be the third in the oak-pine type, which is not as extensive or in some ways as important as the other two major types in the Station's territory. Yet it would be of the greatest possible value in studies of the extremely important loblolly pine subtype. The Lebanon Branch in southern New Jersey being in the pitch pine-shortleaf pine subtype, and the Beltsville Branch in the Virginia pine subtype, the establishment of the Branch under discussion could in no sense be considered a duplication of effort.

Cooperation and Public Relations

The University of Pennsylvania continues its generous policy of furnishing the Station with an office building, two laboratories, the site for our greenhouse, and all necessary services for their use, entirely free of charge.

The establishment of cordial relationships with the Resettlement Administration, a Federal agency acquiring much forest land in submarginal farms, promises a solution of a very difficult problem in the acquisition of experimental forests. At Huntingdon, Pennsylvania, Project Manager Munro of the Administration and Mr. Mollenhauer of the Station, in temporary residence there, have cooperated closely in development work on the Stone Valley tract, previously described. Equally satisfactory have been Station contacts with several other project and regional representatives of both the rural and suburban divisions of the Administration.

The director of the Research Center of the Department of Agriculture at Beltsville, Maryland, has extended every facility to Station work at this projected new branch.

For the Chief Forester's use as "case material" with which to illustrate the influence of good and poor forest management on the survival and prosperity of communities dependent on forest industries, Mr. Wood prepared a report on the Ringwood Estate in northern New Jersey. This estate is a notable example of a forest property being managed for recreation on a commercial basis.

Dr. I. T. Haig of the Washington office of silvical research spent two weeks in the Station territory, including both established and proposed branch stations. Men from four of the other regional experiment stations visited the Allegheny Station. We provided black cherry seed for experiments at the Central States Station, and have contributed information to the Lake States Station and Mr. H. I. Baldwin for their tree seed manual.

Forest Supervisor Gross and staff members of the Allegheny National Forest visited the Kane Experimental Forest from time to time, to see and discuss work in progress and that proposed. Mr. Hough was able to give them data on handling of black cherry seed, and other information of direct value in CCC work and administrative studies. The groundwork was laid for cooperation in wildlife studies by the two agencies.

Through field contacts with local and regional CCC officials Mr. Wood was able to relate our current south Jersey work to camp activities, and to use enrollees in sample plot establishment.

As earlier indicated, very material assistance in improvement work on the Kane Forest was received from the CCC.

Mr. Hough assisted Mr. R. C. Lorenz of the Bureau of Plant Industry in a reconnaissance of the tree diseases of the Kane Experimental Forest and adjacent parts of the Allegheny National Forest. They found the Nectria canker situation in young stands especially alarming; it calls for extensive weedings. Dr. R. M. Lindgren of the B. P. I. also visited Kane to appraise the possibility of future cooperation in disease studies.

Drs. C. W. Collins and T. H. Jones of the Bureau of Entomology and Plant Quarantine, now working at the Dutch Elm Disease Laboratory of the U. S. D. A. at Morristown, New Jersey, visited the Lebanon Experimental Forest and the Philadelphia headquarters to discuss cooperation in entomological studies.

Director Forbes served as a member of the Council for the Crooked Creek erosion project of the Soil Erosion Service, in Indiana and Armstrong Counties, Pennsylvania. The Council comprises, in addition to representative local farmers, the county agricultural agents, members of the faculty and experiment station staffs at State College, and representatives of the Pennsylvania Departments of Agriculture and of Forests and Waters. At a meeting at Indiana, Pennsylvania, the work and plan of the Soil Erosion Service were clearly outlined to the members. Dr. A. L. Patrick and Mr. A. C. McIntyre of the S. E. C. called at Philadelphia to discuss forest types.

The Station has been in close contact with the New Jersey forestry authorities. Director Forbes accompanied several members of the New Jersey Board of Conservation and Development on a field trip in south Jersey, which included a brief stop on the Lebanon Experimental Forest. Plans for the development of a research program on this experimental forest were

discussed with the State Forester and his staff both there and in Trenton.

A most satisfactory understanding was reached with the Pennsylvania Department of Forests and Waters governing future establishment of branch stations in Pennsylvania. The Department has no objections to Federal purchase of the necessary experimental forests in those regions where there are no State forests, but prefers to offer us the use of its own land where it is available. An exception was made, however, in the case of the projected Stone Valley experimental forest.

The Director has aroused some interest in the Pennsylvania Board of Game Commissioners for a joint study of the food habits of the native animals in Tionesta Forest. This is in line with our declared intention to make this area a center of research, both botanical and zoological. Proper coordination of research programs is of course being kept clearly in mind.

The second joint publication by the Pennsylvania State College and the Allegheny Station, elsewhere described, was put in final shape for the printer. The Station anticipates greatly increased cooperation with the College as the result of the projected establishment of the Stone Valley Branch Station. It was the College which originally informed the Station of the opportunity to obtain an experimental forest in this location, and which generously allowed us first choice of tracts to be requested of the Resettlement Administration. Professor Edwards of the forestry department acted in our behalf in drawing up for the Administration early plans for developing the Station as well as the College tracts. It was early agreed between the two organizations that their forest research programs in Stone Valley would be carefully coordinated.

The Stone Valley Branch will also offer a welcome opportunity for increased cooperation with the Pennsylvania Department of Forests and Waters, which administers the State Forests on the surrounding hills and maintains a district office at nearby Petersburg.

Dr. H. P. Brown's project at the New York State College of Forestry for collecting authentic wood specimens of native tree species was aided by Mr. Hough's shipment to him of three logs and herbarium material from Kane.

Members of the staff assisted Professor H. J. Lutz of the Yale Forest School in experimental sowings and plantings on the Pine Plains of southern New Jersey.

The Station has been working closely with the Pennsylvania Forestry Association in its development of plans for a proposed joint meeting with the American Forestry Association, to celebrate the fiftieth anniversary of the State association. The latter association is very anxious to feature the Tionesta Virgin Forest, the purchase of which by the Federal government it was largely instrumental in bringing about, and is considering a meeting to be held in tents at a point adjacent to the forest, rather than the more conventional type of meeting at a hotel in some city.

Members of the staff have been active in the Allegheny Section of the Society of American Foresters, which covers our territory plus the Virginias. Mr. Wood was chairman of the forest practices committee, and Mr. Hough of the forest types committee. Mr. Schnur became secretary of the Section in December.

Mr. Hough helped a party from the Academy of Natural Sciences to select in Tionesta Virgin Forest a beech stand for reproduction as a background for a habitat group of the extinct passenger pigeon. The group will be exhibited in the Academy's museum in Philadelphia.

Publicity for the Station's work was obtained through occasional public lectures by staff members, and newspaper publicity.

The above list of Station contacts with the foresters and public of the Allegheny territory includes only the more important, and does not cover those of the Bureau of Plant Industry men. The latter have been particularly effective in obtaining for the Station recognition and good will from State forestry departments and scientific institutions. Work in the prevention and control of disease by its very nature has a wide appeal, and that of Dr. Jackson and his associates with the diseases of forest nurseries in particular has been of immediate helpfulness to organizations both within and without our territory. The fundamental studies, notably those of mycorrhiza by Dr. Doak, have greatly strengthened the Station's contacts with the University of Pennsylvania and other universities and research institutions.

RESEARCH IN SILVICS

Management, Birch-beech-maple-hemlock (Project M-1) (R.D.Forbes and A.F. Hough)

Ecology of Natural Stands

Kane Experimental Forest

From the results of the systematic strip survey of the Kane Forest made in 1932 the species composition was computed for each age and stocking class and indicated, on a percentage basis, on the final Kane base map. To determine the pathological and physical defects occurring in the 1/10-acre experimental plots of this survey a systematic search for these had been conducted on each tenth plot. The data obtained by this sampling method were tabulated by species and tree sizes (d.b.h.) for each age class.

Cherry Germination Studies. In November the black and pin (fire) cherry seeds collected, sorted, and variously treated during the season, were planted at a uniform depth in screened seed boxes, some located in the open and some beneath a 35-year old stand of hardwoods. Part of the open area had served in 1933 as a place for burning brush and thus afforded, in addition, an opportunity to study the effect of burnt-over soils on seed germination. Some of the seed was furnished to Dr.

Doak of the B. P. I., who is conducting laboratory experiments at Philadelphia to determine the influence of seed-coat sterilization and cold treatments on germination.

East Tionesta Tract

Ecological History of the Virgin Forest Area. Reconstruction of the history of the virgin timber stands on Tionesta Creek, which is expected to give information of great value in determining the principles of silvicultural management for second-growth forests, was vigorously pushed in field and office.

An essential part of this study is the determination of the age of all trees on the ten 1-acre sample plots laid out in these stands. During the winter of 1934-35 a sanding, grinding, and buffing machine was set up in the basement of the Philadelphia office to prepare for age counting the wood sections collected during the previous field season. In all, 5,370 basal sections of trees under 4 inches in diameter at breast height, as well as the V-cuts (pith to periphery) from hemlock stumps on plots #1 to 7, were processed and their rings counted.

The stem maps of all ten plots, one sheet for each 1/4-acre were traced. Prints of these 40 maps were made up into an atlas, which shows for each tree on the experimental areas the species, location, d.b.h., total height, and crown class. The ages are being added as the ring count progresses.

One hundred and eighty saplings collected on these plots were sectioned at 1-foot intervals, and their rings counted, to determine the age required to reach given heights. Height-age curves for slow, medium, and rapid-grown saplings were made for each species. It had been hoped to correct from these curves the stump ages obtained for the large trees which had been cut into sawlogs. It was found, however, that the growth of hemlock and other tolerant species under virgin forest conditions varies so widely during their first 10 to 20 years that although an uncorrected age count on a 2-foot stump may be in error by as many as 30 years, there is no dependable means of determining whether a tree originated from a fast, a medium, or a slow-growing seedling; hence, age corrections based on the analysis of present-day saplings cannot be relied upon. Only counts of the growth rings in V-cuts or sections taken at the root collar - ordinarily, of course, at ground level - have proven to give the correct total age of the Tionesta trees.

Summaries of individual tree records were made to determine the number of normal and defective trees by species and sizes on each plot. Stand tables were also made. Notes on radial cracking and rots were tabulated for the hemlock on plots #2, 6, and 7. The size of all scars and the date at which each occurred was recorded for all trees cut in 1934. These records indicate the intermittent nature of such scarring over a long period. Dates of suppression and release on hemlock sections were also recorded.

Preliminary measurements on sections cut from a much suppressed

hemlock on plot #2 show that annual growth rings may merge or be missing in part of the circumference. There is considerable variation in the width of the same annual ring when measured on 4 different radii of the same section. An analysis of measurements on 2 adjacent hemlocks on plot #6, made at various heights from stump to top, furnished interesting information on the progress of growth during successive 10-year periods. A general agreement in the width of each decade at various heights in the tree could be seen in the graphs secured. The dates of increased growth rate were noticed to correspond in the two trees.

During the 1935 field season a CCC crew of 20 men obtained basal sections from 555 trees, and sections at stump height from 470 trees. All stumps on plots #1, 2, 3, 5, 6, and 7 were butted off at ground level to permit authentic age counts. Logging on plots #4, 8, 9, and 10, has not yet been completed and basal sections of the larger trees on these will have to be obtained in 1936.

The experience gained from the previous winter's office analysis had resulted in detailed plans for the securing of further stem sections and V-cuts. All of the V-cuts and discs made this year were oriented in the field as to compass direction and carefully measured and marked for identification. Selected trees of chemical-wood size were sectioned for stem analysis; permission had been obtained from the Central Pennsylvania Lumber Company to cut all the trees left after the actual logging was done.

To permit the study of the influence of climate and of tree competition on the trees' growth, as indicated by widths of the annual rings, complete discs were sawn from the oldest sound hemlock stumps found on plots #1, 2, 6, and 7. On plot #8 a mature white pine, 30.8" d.b.h., was sectioned for stem analysis, and the several discs were carefully marked to show their original position in the tree. These sections should yield valuable information on the uniformity of growth - both radial and vertical - of a tree grown in a virgin forest, where the surrounding competition is at least partly known.

All the sections obtained were transported from the plots to the Kane Branch Station. There they were dried carefully, broken pieces were glued together, and all the sections wrapped up separately. In December they were brought to Philadelphia by truck and stored in the Botany Annex where they are now readily available for office study.

Influence of Soil Types. The data relating the virgin forest vegetation to the various soil types in East Tionesta were analyzed. No correlation was apparent between soil type and any of the following: total basal area per acre; species composition in terms of basal area; diameter distribution; and advance reproduction. A map showing soil types and species composition of the 1/10-acre plots was compiled, and a report was outlined.

Dying of Hemlock and Beech. A study was made by Mr. R. C. Lorenz of the Bureau of Plant Industry and A. F. Hough of the mortality among

virgin hemlock and beech in the East Tionesta tract and the Deer Lick Run tract some 7 miles northwest of it. The chief factor in this loss, which was almost confined to the mature trees, was found to be the droughts of 1930 and 1934.

Stand Improvement Cuttings

The data obtained in 1933 on the 8 acres of thinning plots known as the Bear Tree plots on the Kane Experimental Forest were analyzed. Stem maps were made for plots #1 and 2, covering 4 acres. Stand tables of both the cut and the reserved trees, basal area tabulations, and tables summarizing the condition of the trees present were made for all the plots. Height-diameter curves were drawn for all species represented.

Reproduction Cuttings

Four plots on Little Arnot Crook were established in 1928 in a 70-year-old stand of mixed hardwoods, including some older growth. The remeasurements made in 1932 were summarized and their analysis completed. All reproduction tallies on the milacre transects were placed on cards and used in computing the abundance and frequency of occurrence of each species, by size classes. The results were put in chart form. Survival and growth data for reproduction on small quadrats, tallied twice yearly, were summarized and plotted.

Data on epicormic branching, mortality, condition, and growth in diameter and height, were tabulated and analyzed.

Three technical notes (#5, 6, and 7), based on studies in these plots were completed. Number 6 dealt with the relative height growth of Allegheny hardwoods, the others respectively with the relation between crown cover and openings resulting from partial cuttings, and with crown spread.

The numerous photographs made in this area were listed by plots, provided with typed descriptions, and compiled in atlas form. All herbarium material was mounted on cards.

The individual tree volumes are being computed by species and plots, using existing volume tables and a new one especially made up for beech.

Managoment, Oak-Pine (Project M-3) (O.M.Wood)

Reproduction of the Principal Species

Reproduction from Seed

Seed Production. Cup counts were made under 2 chestnut oak trees which had been under observation at Camp Ockanickon since 1928. In general the 1935 acorn crop in southern New Jersey was very scanty. Our seed production data for south Jersey were summarized and sent to H. I. Baldwin for use in the preparation of his tree seed manual.

In April about 40 trees of the 11 principal species found on the

western side of the Lebanon Experimental Forest were numbered for identification and their locations plotted on maps. These trees are from 40 to 80 years old, hence all of seed-bearing age. The time of flower, leaf, and fruit development in 1935 was recorded for each tree; similar observations on these same trees will henceforth be made each year. The seed crop of the oaks and pines was very light although early in the spring there had been an abundance of flowers, especially on the oaks. The small flowers of white cedar were difficult to see from the ground, even with binoculars, so that it may be necessary to build scaffolding into the crowns of this species in order to make accurate observations.

Seed Germination and Seedling Survival. In the fall of 1928, 1080 germinating chestnut oak acorns were located on a small area under a group of old trees at Camp Ockanickon. The sole survivor of the resulting seedlings apparently succumbed to competition in 1935.

All natural chestnut oak seedlings at Camp Ockanickon remaining from the 1928 crop, both the trenched and the untrenched, in 1934 were removed from the soil and dried. Their weights were tabulated early in 1935. Although the trenched seedlings were slightly larger than the untrenched the difference was not significant. The chestnut oak seedlings planted in 1929 and trenched in 1931 were also excavated in 1934. The mean dry weight of these was greater than that of seedlings from an adjacent untrenched bed. However, the total number in each case was so small that the significance of these results as a means of determining the effect of eliminating root competition is doubtful.

No measurements were made in 1935 of the various species of oak seedlings in the several beds at Camp Ockanickon previously treated with ground limestone, but soil samples were again collected for pH determinations. The 1934 measurements from the 1931 beds were analyzed and show that the growth continues to be best in the light-limed bed, although it is only slightly better than that in the heavily-limed. The growth of the more abundant species in both of the treated beds was significantly better than in the control bed.

The 1934 height measurements of oak seedlings in the beds treated with potash in 1931 were analyzed statistically, and the difference in growth between the treated and control beds was found not to be significant. Growth was slightly better in the control bed, indicating that the potash treatment may be detrimental.

From the general observation of all seed beds planted to oak at Camp Ockanickon it was concluded that the most promising results come from controlling litter and physical soil conditions rather than from changing the chemical condition of the soil. For this reason some of the beds established at the Lebanon Forest in 1934, and planted with white, chestnut, and black oak acorns, were spaded free of all foreign roots, others were left unspaded; some were planted with, others without, a litter cover. Some were trenched.

The germination in all these beds was fairly good in 1935.

Although height measurements have not yet been analyzed, it is evident that growth in the beds exposed to full sunlight has been much better than in the beds of the woods. Trenching and spading of the beds in the woods, to remove all root competition, has apparently not improved height growth. On the other hand, growth in the unspaded beds in the open was fairly good. This indicates that sunlight, as has been found also at the Central States Station, is the controlling factor in the early survival of oak seedlings.

Reproduction from Sprouts

In 1930 four 1/2-acre plots were laid out in a 7-year old stand of oak and pine at Camp Ockanickon for stand improvement studies. Today these plots serve two experimental purposes: first, in the coppice-to-high forest conversion studies discussed later; second, in a study of sprout formation as influenced by varying degrees of cutting. In the latter study a 1-acre plot near two of the four plots, which had been thinned to one or two stems per sprout clump, was clear-cut in the same year. In 1934 transects were run across the clear-cut and the thinned areas. This year the basal area of the stumps remaining from the 1930 cutting was computed, and the number of sprouts arisen from these stumps per unit of basal area determined for each plot. The data are about ready for publication.

Conversion from Coppice Stands to High Forest

Because the open, predominantly sprout-hardwood stands characteristic of much of southern New Jersey are less in need of thinning than of conversion to high forest of mixed oak and pine, stand improvement experiments here are better designated conversion studies than thinning studies.

Of the four 1/2-acre plots at Camp Ockanickon mentioned in the preceding section, two had been left undisturbed in 1930, except that the trees which would have been left had they been cut in the same manner as the first two, were numbered and measured. In 1935 the stand on all four of the plots was remeasured. Computations to date indicate that the diameter increase was greater, and the height increase less, in the thinned plots than in the unthinned.

Data from a strip survey made of an adjacent CCC stand improvement cutting served as a guide in the selection of an area in young sprout oak stands on the Lebanon Experimental Forest in which to make similar cuttings on an experimental basis. For reasons just given, the experiments were planned chiefly to determine the method of cutting best adapted ultimately to convert sprout hardwood stands into high forest of oak and pine. In order to compare the results from 3 different degrees or methods of thinning with those of non-cutting, and to have 4 replications of those experiments, the area of 4 acres was laid out as a 16-plot Latin Square. Each of the sixteen 1/16-acre plots is surrounded by a 3/16-acre isolation strip. In each set of 4 plots, 3 will have respectively 70, 50, and 30 per cent of the existing stand removed, and the 4th will be kept intact as a check.

The entire 4-acre area was stem mapped. The trees to be left in each degree of cutting were marked at breast height with paint of a distinctive color. The trees on the 4 control plots are marked in 3 ways, each with its own color, to permit their serving as controls for each of the 3 degrees of cutting. Tabulation of the stand on each plot was completed in the office. A comparison of these tabulations confirms the field determination that the Latin Square arrangement produced samples that were fairly uniform for each of the 4 treatments.

Actual cutting by a WPA worker, begun in November, was about 1/3 complete at the end of the year.

Mensuration, Oaks (Project ME-2) (G.Luther Schnur)

The oak yield manuscript, in revised form, was submitted to Washington, early in the year. Because lack of funds for printing makes the early publication of this bulletin almost hopeless, the Station mimeographed the 45 volume tables and distributed them in considerable numbers to several organizations which had requested them. A good deal of effort was expended in devising a system of indexing and filing the extremely bulky mass of field and office data from this study in such a manner as to make any part of it easily available for future reference.

Data from the first 5-year remeasurement of the 14 permanent yield plots in oak at Camp Ockanickon were transferred to atlas sheets, and the necessary computations of volumes were completed.

The statistical analysis of the volume comparison data was completed during the year. In this analysis Schumacher and Hall's logarithmic method was used to express volume, and the "standard error of the function" in making comparisons. As might have been expected, chestnut oak showed the greatest variation in form, and was the only species to show a significant difference from other species on the same area.

Mensuration, Oak-Pine (Project ME-3) (G.Luther Schnur)

A manuscript on the effect of stand density and basal area on mortality and growth of loblolly pine, with special application to thinnings, was submitted to Washington for publication. A paper by Mr. E. M. Simmons on a basal area-ratio method of site classification was put into preliminary form and submitted to Washington for informal criticism.

The seventh 5-year remeasurement of the plots established in loblolly pine on the Eastern Shore of Maryland in 1906, was begun. Owing to cuttings and depredations in these plots, which are on private lands, the number of those usable is constantly decreasing, and it appears doubtful whether future measurements on the remaining plots is justified.

Interplanting, New Jersey Coastal Plain (Project Fp-3) (O.M.Wood)

A summary of the 1930-1934 measurements on the planting project at Camp Ockanickon was completed early in 1935, and used by Mr. A. G. Randall as a basis for the preparation of a manuscript. Extensively revised by Mr. Wood, it will shortly be submitted for publication.

Forest Types

As chairman of the Forest Types committee of the Allegheny Section of the Society of American Foresters, Mr. Hough wrote a description of the broad type groups and subtypes occurring in the Allegheny Section territory. In this connection he made a trip into West Virginia to observe the character of the forest types there.

Special Studies (G.Luther Schnur)

The manuscript on the effects of the 1930 drought, a result of the cooperative study between the Station and the Pennsylvania State College, was revised, put in final form, and submitted to the College for publication.

RESEARCH IN FOREST PATHOLOGY

Mycorrhizae (B.P.I. Project 6P) (Dr.K.D.Doak)

Secondary Parasitism of Mycorrhizae

Among the fungi cultured during the preceding three years, several species after culturing had proven to consist of more than one physiological strain. It had been found that strains of non-mycorrhiza forming fungi differ in parasitic behavior. Mycorrhiza-forming fungi might, it was believed, differ in the same manner. Since the knowledge of these properties in the strains found would be of great value in estimating how to organize the inoculation work proposed for nursery soils, it was decided to determine their mycorrhizal habits and make a comparative study of their mycelial characters by means of a new series of pure culture experiments.

The first evidence that more than one physiological strain can be obtained in pure culture was shown by Boletinus porosus and Boletus granulatus. During the 1934 growing season direct isolation gave several strains of Boletus granulatus which appeared to correspond to the strains obtained by making isolations from the sporophores. Much work was done on this study during the past year. The experiments will probably be completed before the end of the fiscal year.

Culture Methods

The nutrient absorption studies carried on since 1933 were continued along the same line, but with the addition of a micro-chemical comparison of mycorrhizal and non-mycorrhizal roots grown in pure culture. The micro-chemical methods of Dr. S. H. Eckerson of the Boyce

Thompson Institute were used in part of this work. Previous evidence obtained by a thorough study of absorption of dyes indicates that a difference does occur in roots covered by an ectotrophic mycorrhizal mantle and roots free from fungus association. Along with the microchemical study of roots killed by various fixatives, absorption studies with dyes undergoing different color changes in the presence of known secondary thickenings and storage materials were undertaken.

Growth Relations

Several preliminary growth comparisons with white pine and pitch pine and their more important mycorrhizal fungi were started and will be completed before July 1, 1936. Results from the use of organic nitrogen forms are being compared with those from similar experiments made during the past four years and in which the inorganic forms were used. It is expected that this final evidence will complete the preliminary growth studies to be published in the near future, along with those of the effects of moisture and several inorganic nutrients on the development and longevity of mycorrhizae in pure culture.

Relation of Mycorrhizae and Pseudo-mycorrhizae to Coniferous Species in Nurseries

Root systems of seedlings of various coniferous species, grown in the nurseries of the Allegheny Region and several midwestern nurseries, have been obtained for determining the mycorrhizal development in different soils and with different fertilizer treatments. This requires examination of a large number of these root systems and actual counts of the various kinds in order to establish the amount of mycorrhizal and pseudomycorrhizal development, and, in every case is followed by a histological study to verify the character of the forms occurring. It is expected that the reports of this work will give some indication of the action of fertilizers in changing the amount of mycorrhizae and pseudomycorrhiza developed with one-year-old seedlings. Many of the nurseries represented are new sites and unusual variations in growth of different species and effects of fertilization have appeared.

Isolation and Classification of Known Species of Fungi

In connection with the identification of fungi obtained by direct isolation, a key is in course of preparation to identify them by their mycelial characters and will be completed at an early date. It is based on the mycelial characters of species grown from sporophores and will represent the entire culture collection obtained during the past four years. This key will be invaluable to future workers making isolations directly from mycorrhizal roots in different parts of the country where it is impossible to obtain sporophores of the fungi involved. Enough evidence has been gathered to show that many mycorrhizal fungi can be identified by this method. In connection with the key mentioned, an attempt has been made to classify certain sterile mycelium fungi obtained directly from roots and associated with or forming mycorrhizae in nurseries. The latter key will be based on keys already organized for such fungi by Elias Melin (1923-1925) and H. Burgeff (1932), two European workers who have studied these fungi for many years. Sterile mycelium fungi have been found in many cases associated with pseudomycorrhizae

and the evidence obtained from counts of all the types of short roots on the root systems of nursery stock in the Allegheny Region indicates that pseudomycorrhizae are more abundant, in several nurseries and on certain species, than mycorrhizae.

Nursery Diseases (B.P.I. Project 2P) (Dr.L.W.R.Jackson)

A study of the hydrogen ion tolerance of certain damping-off parasites was started by Miss Leven, a student at the Botany Department of the University of Pennsylvania. The results obtained to date indicate that some fungi are quite sensitive to high acidities and are killed at pH 3.5 and 3.6 while others, more tolerant, are not killed until a pH of 2.0 is reached.

During the 1935 field season disease control experiments were run simultaneously at 3 forest nurseries in the eastern territory. To each of these a field assistant, temporarily employed on ECW funds, was assigned. A fourth assistant, Mr. Aaron, carried out the soil acidity tests and the other laboratory work involved.

The main objective of these studies was to test out the effect of certain soil acidification treatments on the control of damping-off and of root rot diseases of coniferous seedlings.

The acidifying agents used in the tests were aluminum sulphate, sulphuric acid, hydrochloric acid and sulphur. Two methods of treatment were used, surface application and soil treatment to a depth of 6 inches. To attain acidification to a depth of 6", the chemical had to be worked into the soil by means of rakes.

In addition to those with acidifying agents, treatments with the following chemicals were tested: ferrous sulphate, formaldehyde, phenol, cresol, salicylic acid, acetic acid, and sodium benzoate. These materials were generally used as surface treatments at the time of sowing.

All of the tests were run on 2' x 4' plots.

Complete data were obtained on early and late damping-off losses, changes in soil acidity, effect on weeds, seedling emergence, rate of germination, subsequent growth, development of the seedlings, and numerous other factors.

The plot work at the Mont Alto nursery was conducted by Mr. Frank Kaplan and involved the establishment of 181 experimental plots. The tests with practically all the chemicals mentioned proved deep soil treatments with inoculated sulphur, aluminum sulphate, and sulphuric acid to give the most satisfactory results.

At the Washington Crossing New Jersey State Nursery the plot tests, made on 200 plots, were conducted by Mr. Wean. The treatments with formaldehyde and salicylic acid gave the best results.

Mr. Latham carried out the plot tests at the Parsons, W. Va. nursery, establishing 150 plots. Both aluminum sulphate and sulphuric acid gave satisfactory results.

The data obtained in these field trials are being analyzed. Reports and recommendations will be prepared and submitted to the cooperating forestry agencies.

In addition to the plot tests, acidity maps were made for the following State forest nurseries: Mont Alto, Rockview, and Greenwood Furnace, Pa.; Washington Crossing, Newark Watershed, and Greenbank, N.J.; Delaware State Nursery; Sunnyside, Maryland; and Parsons, W.Va. These maps show the variations in soil acidity by pH numbers throughout the respective nursery areas.

A study of the fungi causing damping-off and root rot diseases was made at the following nurseries: New Jersey State Nursery, Parsons, W. Va., and Mont Alto, Pa. Several new parasites, capable of causing those two diseases, were discovered. Those new organisms are being tested in the laboratory greenhouse in Philadelphia.

The most prevalent damping-off and root rot parasites in this region are Pythium and Rhizoctonia. The field observations show that those organisms are more destructive on weakly acid than on strongly acid soils.

In 1935 a laboratory method was developed for predetermining the amount of either aluminum sulphate or sulphuric acid that should be added per square foot of soil in order to increase the acidity to any desired degree and depth.

Practically all the deep soil acidification tests run in the nursery plot experiments during the summer were made according to the estimates obtained by this method and the results were very satisfactory. The method is being used now to determine the acid requirements for a large number of nurseries throughout the United States. So far approximately 30 nurseries, many of them connected with the Soil Conservation Service, have sent in about 200 samples. The laboratory work on these is being done by Mr. Kaplan, on ECW funds. About 800 soil pH tests are made per month.

Service work has been extended to a large number of nurseries throughout the entire country. The cooperative work consisted of answering inquiries for disease control methods, soil pH determinations, diagnosis of diseased seedlings, and many other questions. The amount of this work that could be done, however, had to be restricted unfortunately on account of lack of time and personnel.

The results of the investigations on various phases of the nursery diseases project were laid down in the following office reports:

*A relationship between pH and height growth of black locust in the Mont Alto nursery.

*The effect on pH soil suspensions of each of the following factors:

the time of settling.
the use of barium sulphate as clarifying agent.
evacuation.
rate of dilution.
quantity of soil and size of container.

Effect of aluminum sulphate on soil reaction as determined by 5-lb. sample tests.

*Calculations and conversion tables used for the acid requirement method.

The application of the acid requirement data, based on results from nurseries in the Allegheny region.

Results from the 1935 disease control projects at Mont Alto, Pa. and Washington Crossing, N.J.

Effect of artificial acidification on soil colloids.

*Reports on each of the soil pH profiles (acidity maps) mentioned above.

*Ready for release.

Disease Survey (B.P.I. Project 1P2) (Dr.L.W.R.Jackson)

The severe dying in the Norway pine plantations on the watershed at York, Pa., reported in 1934 by Professor Perry - then of the Mont Alto Forestry School -, was diagnosed as partly due to drought injury. Besides, a serious case of root rot was found, however, and is being investigated further.

A large number of inquiries was received in regard to the twig blight prevalent among the Austrian and the dying of Himalayan pines in the Philadelphia area. Although both of these diseases are causing a large amount of damage, no investigative work on them has been possible beyond the making of general field observations.

The investigation of the plane tree disease, threatening their extermination in the Philadelphia area, and which is particularly severe in the Delaware County suburbs, was continued. Dr. Sleeth from time to time assisted in this work. The seriousness of this new disease is enhanced by the recently discovered fact that, although it has hitherto been confined to the European sycamore (Platanus orientalis), it is transmittable to the native species (P. occidentalis).

Decay of Sprout Hardwoods (B.P.I. Project 3P) (Drs. Jackson and Sleeth)

The study on the distribution and the manner of transmission of butt decay in oak sprouts was continued during 1935 on ECW funds. The field work was done by Dr. B. Sleeth, working from the B. P. I. branch here.

Six 1/4-acre plots of sprout oak reproduction in Pennsylvania were cut, 3 in the Logan State Forest and 3 near Dix on an area being logged by Mr. F. R. Mattern of Warriors Mark. The trees cut ranged in age from 15 to 48 years. Of the 539 trees cut 266 were white, 127 red, 74 rock, 53 scarlet, and 8 black oaks. Slightly over 29 per cent of all the trees cut had butt rot. In approximately 25 per cent of all the trees the decay had entered from the parent stump; in 4 per cent the point of entrance was undetermined. Fire scars as entrances of decay had been eliminated by locating the plots in stands entirely free from such scars.

Resistance to butt rot infection seems to be higher in the rock oaks than in the other oak species. Scarlet oak appears to be the most susceptible oak. Only 12 per cent of the rock oak trees had butt rot, compared with 26 per cent for red, 29 per cent for white and 50 per cent for scarlet oak.

The fungus Stereum gausapatum was responsible for 64 per cent of the butt rotted trees. Polyporus spraguei, P. sulphureus, Armillaria mollea, S. frustulosum, Hydnum erinaceum, and a number of other unidentified fungi were isolated from the remaining 36 per cent of the decaying trees. The maximum height observed for S. gausapatum was 12 feet in a 48-year old scarlet oak. It often gains entrance into sprout oaks at an early age. In one plot cut it had entered twenty 15-year old red oak sprouts from the old stump, and in one 15-year old red oak sprout it had invaded the heartwood to a height of 48".

Several factors were found to be related to the entrance of decay in sprout oaks. The more important of these are the size of the old stump, the height at which the sprout originates on it, the vigor of the sprout, fires and their frequency, and the kind of fungus that infects and decays the old stumps.

Most of the 4-1/2 months' field season, spent in Connecticut, was devoted by Dr. Sleeth to a field study of butt rots in oaks, a study similar to that of decay in sprout oaks in the Allegheny region. A number of oaks were inoculated with fungi, cytospora and coryneum species, which Mr. R. W. Davidson of the Washington office had isolated from material of dying oaks collected by Dr. Sleeth in Connecticut.

In cooperation with Mr. Bradford Bidwell of the Connecticut Forestry Department a study of Polyporus hispidus decay and associated cankers was made in a badly infected area of the Nehantic Forest near Lyme. All affected trees on a 1/2-acre plot were cut and data collected on the extent of decay and its point of entrance. Specimens were taken

from the dissected trees and sent to the Washington Office for culturing. To determine the distribution and amount of infection a survey was made of the area surrounding the plot. As many as 7 cankered trees to a 1/10-acre plot were found. The average number was 8 - 12 per acre over an area of approximately 50 acres. Cankers with P. hispidus were found on rock, black, white, and red oaks; however, many of the cankers had no P. hispidus fruiting bodies. The largest number of cankered trees were rock and black oaks, the two more abundant oaks in the area surveyed.

An examination in June of the plots at Sand Springs near State College, Pa. - where in October-November 1934 inoculations had been made with Strumella - and reisolations from a number of inoculated branches collected there, showed that the fungus had been able to establish itself in the tissues.

PART II

PLAN OF WORK
for the
FISCAL YEAR 1937
(July 1, 1936 to June 30, 1937)

PLAN OF WORK FOR THE FISCAL YEAR 1937

ADMINISTRATION

The Bureau of the Budget did not approve any increase in the continuing funds of the Allegheny Station for the fiscal year 1937, beginning July 1, 1936. The Station's plans for that year are therefore based on our receiving the same sum in both fiscal years - $23,350. Temporary funds are not assured beyond June 30, and only the most tentative plans can be based on emergency allotments beyond that date.

Advisory Council

The enlarged Council, composed of influential men representative of wider interests than ever before, is willing and anxious to undertake an active campaign for increased forest research by all agencies - Federal, State, and private - in the Station territory. Close cooperation to that end is among the leading objectives in the administration of the Station.

Branch Stations

Existing branches. Advantage will be taken of every opportunity to obtain emergency allotments to complete the improvements and facilities needed at the Lebanon and Kane Branches. At Kane these are now reasonably adequate to present needs, except for the erection of a water tank for fire protective and general purposes. At the Lebanon Branch, however, the Station plans to erect at the earliest opportunity a resident superintendent's house, and to follow it with the standard improvements prepared for such field stations.

If available, emergency funds will be used to maintain and intensify the fire protective system and for simple stand improvement work on a large scale (less frequently on an exporimental basis) at both branches; also, at Kane, to install stream gauges, silt-measuring devices, and additional rain gauges, as part of the meteorological equipment.

Projected branches. Erection of necessary buildings for our use at the Stone Valley and National Agricultural Research Center branches is planned by the Resettlement Administration, which is acquiring the land. The Administration's plans for less expensive improvements, or those requiring small outlay for materials as compared to labor cost, include fire lines, woods roads and trails, fences, etc. Where necessary, the Station will endeavor to supplement this program from emergency funds.

RESEARCH IN SILVICS

Until the Station receives additional regular funds, no significant expansion of its silvicultural research is possible. However, owing to the virtual completion of the oak mensuration project, one of the four Forest Service technicians is free to devote most of his time to a new project -- management of oaks. The setting-up of this project is the widest departure from the plan of work followed for several years past. Another important change is a shift in the emphasis of immediate work in the oak-pine type of southern New Jersey from the management project to the fire damage project.

Management, Birch-Beech-Maple-Hemlock (Project M-1)(R.D.Forbes and A.F. Hough)

Ecology of natural stands.

The manuscript on the virgin forests of the northern Allegheny Plateau will be completed, and will include a discussion of the silvicultural implications of the data presented. Measurements on the 10 sample plots established in the Tionesta Forest in 1934 will be completed during the current season, but this and earlier information will necessarily be incorporated in a later paper.

In close cooperation with the Allegheny National Forest, studies will be undertaken for the first time of the vegetation in and adjacent to the plots fenced in 1935 against rabbits, and deer and rabbits, on the Kane Forest.

Stand improvement cuttings.

After a thorough study of CCC cuttings in similar stands, we will begin experimental weedings and cleanings in young stands - between 10 and 15 years of age - on the Kane Forest. The number of sample plots established in 1936 will be strictly limited by the technical man-power available.

Reproduction cuttings.

A number of Technical Notes, drawn from such of the data from the 5-year remeasurement of the Little Arnot plots as are significant, will be prepared.

In addition to the above formal activities in the type, the Station will make a determined effort to enlarge its acquaintance with present commercial woods practices, particularly in chemical wood cuttings throughout its territory, and with timber sale practices on the Allegheny National Forest. Since the extensive surveys of 1928-30 pressure of formal work and reduction in travel funds have seriously narrowed the Station's outlook. A concrete opportunity for wider contacts is afforded by cooperation with the Allegheny National Forest and the Armstrong Forest Company, Johnsonburg, Pennsylvania, in a survey of their plantations; the Forest will contribute the services of a Junior Forester, and the Station a working plan and a certain amount of supervision.

Management, Oaks (Project M-2) (G. Luther Schnur)

The oak type (a shortened and now more descriptive term for oak-chestnut-yellow poplar) is by far the most extensive of the three major forest types in the Station territory. It exceeds the other two also in the variety and volume of wood products, importance to streamflow regulation, and intensiveness of recreational use. The problems it presents for investigation are correspondingly numerous and diverse.

One of the Allegheny Station's major projects - mensuration of the oaks - has dealt with this type, and through the cooperation of our sister Stations has furnished volume, yield, and stand tables for the upland oaks of the entire eastern United States. A special study has covered some effects of climatic variation, particularly the 1930 drought, on the composition of this type in a single locality in Pennsylvania. The research of the Pennsylvania Department of Forests and Waters and of Pennsylvania State College has been centered in this type. The sum total of all work done in it to date, however, falls far short of that needed in every phase of research except mensuration.

The completion of the oak mensuration project in its major aspect releases Mr. Schnur for other work, and coincides with the Station's expected acquisition of at least one experimental forest in the oak type - that in Stone Valley, Huntingdon County, Pennsylvania. The forest at a second projected branch, the National Agricultural Research Center near Beltsville, Maryland, although falling within the boundaries of the oak-pine type, contains some stands representative of the oak type. With these facilities for work, the Station is preparing to set up an oak management project in 1936. The particular phase of this large subject which demands first attention will be selected only after consultation with the administrative and research agencies of the territory.

Fire damage, Oak-pine. (Project Pf-3) (O.M.Wood)

A study of fire damage in the Allegheny territory as a whole was early included among the approved projects of the Station, but because of lack of funds never became a major project. A small amount of work was done in southern New Jersey following the severe fires of 1930. Eleven semi-permanent sample plots were established in that year in stands of varying composition and age, and were re-examined in the two following years - a long enough period to secure accurate figures of mortality. The data were not published by the Station, but were released for use by a professor in the forestry department at Pennsylvania State College, in two publications presenting available data on fire damage throughout the United States.

A localized study of the effect of fires has been proposed for southern New Jersey by the State Forester of that State. He regards this study as of greater importance than the management project on which the Station has hitherto concentrated its efforts, and this circumstance leads us to change the emphasis in the south Jersey work.

The 1,500,000 acres of oak-pine forest in southern New Jersey lie at the door of some of the greatest cities in the East, in three States. Once of very high value as wood producers, and capable of restoration as such, they have been largely reduced by two centuries of cutting, and particularly of fires, to remnants of second growth, separated by desolate stretches of scrub oak and stunted pine. Even in their degraded condition some large areas furnish excellent hunting, and "the ozone of the pines" still attracts recreationists in great numbers to the few localities where mature pine survives. On thousands of acres in some townships, on the other hand, the forest resource has been so reduced that no taxes have been paid for years.

Thirty years' effort by the New Jersey foresters has not yet solved the problem of protecting the oak-pine lands against periodically destructive fires, and the region is known as one of the worst fire areas in the Northeast. A great obstacle to obtaining adequate funds for the intensive protective system obviously necessary in a highly-inflammable forest type is lack of concrete knowledge of the damage caused by fires, from which to determine justifiable expenditures for protection against them. The more depleted the forest resource, the less the tax payer is willing to spend in its protection, and the less is spent, the worse the depletion. The forests of south Jersey not in public ownership are thus on a descending spiral of exhaustion. At the bottom of the spiral is the 20,000 acres of scrub vegetation known as the Plains, which a recent study by Professor H. J. Lutz, formerly of the Station staff, and now of the Yale Forest School, has demonstrated to be the result of unusually severe burning.

One of the objectives of the proposed study is, therefore, to determine the values at stake in fire protection. Another will be to weigh against the heavy fire losses still suffered at intervals in south Jersey from accidental and uncontrolled fires, the much lighter losses which may be expected to result from fires deliberately set under favorable circumstances and carefully controlled. This will necessitate "controlled burning" of experimental areas, and the keeping of accurate cost records at every step of the investigation. The fullest cooperation of the administrative men is particularly essential in this phase of the work, and is assured us by the New Jersey authorities. The working plan for the study will be jointly prepared, and its execution shared, by the two organizations. Mr. Wood will curtail his work on other south Jersey projects so as to devote from one-half to two-thirds of his time to the fire damage study.

Management, Oak-pine (Project M-3) (O.M.Wood)

In order to release Mr. Wood so far as possible for participation in the fire damage project (q.v.), it will be necessary to confine work on this project almost entirely to a follow-up of that already under way.

Reproduction

Seed counts for the 2 chestnut oaks at Camp Ockanickon, and for as many as possible of some 40 trees on the Lebanon Experimental Forest, will be repeated. The last of the oak seedlings in the Camp Ockanickon beds will be removed for dry weight and other measurements, and observations will be continued on the 18 oak seed beds at the Lebanon.

A paper will be prepared summarizing the data so far obtained on the factors affecting seed production, survival, and germination, and seedling survival, of chestnut oak in south Jersey; also Technical Notes and brief articles on various aspects of the phenomenon of sprouting. Meteorological studies incidental to the major project will be drawn upon for similar published notes.

Conversion to high forest.

Field and office work on the 16 plots laid out in 1935 will be completed. Quadrats necessary to the observation of seedling reproduction will be established.

Mensuration, Oaks (Project ME-2) (G. Luther Schnur)

Only minor phases of this project, as at present set up, remain for study in 1936.

A paper setting forth the results of the tree volume comparison study will be written. Two sets of comparisons have been made for this study: one compares the volumes of trees of different species growing in one locality, the other the tree volumes of like species growing in different localities.

A brief article will be prepared dealing with the difference between the growth of trees on the permanent growth-plots located in the "safety strip" at Camp Ockanickon, from which the brush was removed, and that of trees on adjacent plots where they continued to grow in competition with heavy underbrush.

The growth rate found on the plots just mentioned will be compared with that derived from existing yield tables; if significant results are obtained from this, they will be described in a short note.

Plantations, Birch-Beech-Maple-Hemlock (Project Fp-1)(A. F. Hough)

The opportunity for some highly desirable cooperation with three agencies - the Lake States Forest Experiment Station, the Allegheny National Forest, and the Armstrong Forest Company - in the field of artificial forestation in the birch-beech-maple-hemlock type, compels the Station to set up at least a minor project of plantation studies.

The Lake States Station's project (B-1) to test the climatic forms of Norway pine, a species widely planted in the Allegheny Station territory, entails a trial of several such forms here, and it is appropriate that the Allegheny Station should conduct the test. With this in

view a 4.5-acre planting site adjacent to the open-ground meteorological station on the Kane Forest, was cleared and plowed with CCC labor in 1933. White grubs destroyed the planting stock in the Lake States nursery and prevented planting this site in 1934, but 2-1 stock will be available for it in the spring of 1937. Meanwhile, invading vegetation, including tree sprouts, has been kept in check, and in 1934 1/2-acre was fenced against deer and rabbits.

Since 1909 the Armstrong Forest Company, a private company affiliated with the large pulp and paper industries of Johnsonburg, Pennsylvania, has planted 3000 acres, and since 1928 the Allegheny National Forest has planted 9000 acres. Most of the area thus planted was cut-over and burned land in the aspen-pin cherry subtype, the balance abandoned farmland. Norway pine, Norway and white spruces, and other species in small quantities, were used. Both agencies are very anxious to review the results obtained from their work. The National Forest has offered to assign a Junior Forester to make, under our direction, a survey of the combined plantations. The Station will assume responsibility for the preparation of the working plan, and will offer some facilities for computing the data. Every effort will be made to obtain enough field data in 1936 to establish the fact of success or failure of the principal species on the more easily recognized sites; to ascertain the reasons may require extension of the study into 1937.

Mensuration, Oak-Pine (Project ME-3)(G. Luther Schnur)

The seventh remeasurement of the loblolly pine permanent sample plots at the Eastern Shore of Maryland will be completed before the start of the growing season. The data obtained will be put into such a form that they can be readily punch-carded at the Washington office for further analysis.

A practicable method of applying the thinning information obtained during earlier studies to stand-improvement work will be outlined and an article on it prepared for publication.

This is all the work that can be done on this project with present personnel. However, should the Station succeed in its efforts to obtain through the Resettlement Administration an experimental forest on the Eastern Shore of Maryland, the presence of a nearby CCC camp offers an excellent opportunity to apply the knowledge already gained in this project to stand improvement studies on an extensive scale. This opportunity will be made the basis of a request for enough ECW research money to finance the employment of two technicians to direct the work.

Interplanting, New Jersey Coastal Plain (Project Fp-3)(O.M.Wood)

No field work is necessary in 1936. The paper summarizing the first 5 years' results will be revised for publication.

Special Studies, 1930 Drought (G. Luther Schnur)

No further work than the correction of the printer's proofs is anticipated on the joint manuscript written by Messrs. Schnur and McIntyre.

RESEARCH IN FOREST PATHOLOGY

Mycorrhizae (B.P.I. Project 6-P)(Dr. K.D.Doak)

In addition to carrying on during 1936 the work on several phases of the mycorrhizae project already under way, it is planned to start early in the spring a study of the effects of inoculation of nursery beds for changing the mycorrhiza development. If approved by the Washington office, this study will continue until the spring of 1937, at which time part of the material will be transplanted. Observations and experimental work will continue for several years thereafter.

Decay of sprout hardwoods (B.P.I. Project 3 P)(Dr. Bailey Sleeth)

Arrangements have been made with State District Forester Clopper and Research Forester Kase to set aside a number of butt decay plots in the Mont Alto Forest. Research facilities of the Mont Alto organization were put at Dr. Sleeth's disposal for his studies.

With Mr. R. M. Lindgren of the Washington office, who visited the laboratory in December, plans were made to establish 10 more 1/4-acre butt decay experimental plots in Pennsylvania, Maryland, and West Virginia. It is hoped to complete cutting on these plots by May 1936. After completion of the work on these plots, a report on the decay situation as found in sprout oaks will be compiled in conjunction with a similar study being carried on in Virginia.

If it is found possible to complete the work on oaks as now planned, before the end of the year, work of a like nature will be started on northern hardwoods.

PART III

MANUSCRIPTS

Manuscripts Published

Author	Title of Manuscript	Name of Publication	Date of Issue	Remarks
RESEARCH IN SILVICS				
Andrews, S. F.	The incidence of Nectria canker in the sugar maple-beech-yellow birch type near Kane, Pennsylvania	Thesis, Yale School of Forestry	1935	In Yale library
Hough, A. F.	A method of preparing wood sections for accurate age counts	Journal of Forestry	July, 1935	
McQuilkin, W. E.	Root development of pitch pine, with some comparative observations of shortleaf pine	Journal of Agricultural Research	December 1, 1935	
Wood, O. M.	Forest removal affects local climate and growing conditions	U.S.D.A. Yearbook	1935	
Schnur, G. Luther	45 Yield, stand, and volume tables for even-aged upland oak forests			Mimeographed
Forbes, R. D.	Forest area annually cut over	Technical Note #8	October 1, 1935	"
Hazen, J. F. and Wood, O. M.	Animal damage in relation to size of planting stock	" " #4	May 21, 1935	"
Hough, A. F.	Crown cover and open space before and after partial cutting on permanent sample plots	" " #5	June 19, 1935	"
" "	Relative height growth of Allegheny hardwoods	" " #6	June 19, 1935	"
" "	Crown spread of Allegheny hardwoods	" " #7	June 19, 1935	"

Author	Title of Manuscript	Name of Publication	Date of Issue	Remarks
RESEARCH IN FOREST PATHOLOGY				
Doak, K. D.	Suggestions for analysis of mycorrhizal conditions of coniferous nursery stock (4 pp.)			Mimeographed
" "	Directions for surface sterilization of mycorrhizal roots with chloramine (2 pp. 2 ill.)			"
" "	Mycorrhizae and their relation to shade trees. (9 pp.)			
" "	Relation of mycorrhizae and pseudomycorrhizae to conifer seedling chlorosis (5 pp. 7 tables)			"
Doak, K. D. and Hatch, A. B.	A critical review (12 pp.) of "The relation of mycorrhizae to conifer seedlings" by R. E. McArdle in Journal of Agricultural Research, No. 44, 1932, pp. 287-316			"
Lisi, A. G. and Doak, K. D.	An abnormal Amanita muscaria	Proceedings Pennsylvania Academy of Sciences	1935	9:86
Jackson, L. W. R.	A new disease of the Oriental plane tree (Platanus orientalis L.) prevalent in the Philadelphia area.	11th National Shade Tree Conference	1935	

Manuscripts Submitted

Author	Subject of Manuscript	For publication in	Remarks
RESEARCH IN SILVICS			
Hough, A. F.	A climax forest community on East Tionesta Creek in northwestern Pennsylvania	Ecology	Published January 1, 1936
McIntyre, A. C. and Schnur, G. Luther	Some effects of climate variations on the oak forests of Central Pennsylvania, with special reference to the 1930 drought	Pennsylvania State College Bulletin	Published March, 1936
Morey, H. F.	Age-size relationships of Heart's Content, a virgin forest in northwestern Pennsylvania	Ecology	Published April, 1936
" "	A comparison of two virgin forests in northwestern Pennsylvania	"	Published January 1, 1936
Schnur, G. Luther	Yield, stand and volume tables for even-aged upland oak forests	Departmental bulletin	
Simmons, E. M. and Schnur, G. Luther	Effect of stand density and basal area on mortality and growth of loblolly pine, with special application to thinnings	Journal of Agricultural Research	Resubmitted
Wood, O. M.	Survival and early development of some pine interplantings in southern New Jersey	Journal of Forestry	
Hough, A. F.	The dying of hemlock and other species on the Allegheny National Forest	Technical Note #9	Mimeographed dd. January 14, 1936

Author	Subject of Manuscript	For publication in	Remarks
RESEARCH IN FOREST PATHOLOGY			
Doak, K. D.	Mycorrhizal fungi of nursery stock and their relation to nursery practice	Phytopathology	
" "	Effect of nutrition and moisture supply on the development of coniferous mycorrhizae in pure culture	Plant Physiology	
Doak, K. D. and Barenbaum, M.	Relation of forest tree roots and the fruiting of Agaricaceae, Boletaceae and Gasteromycetes to the mycotrophic habit	Ecology	

Manuscripts proposed for the fiscal year 1937.
(exclusive of Technical Notes, circulated in mimeographed form)

Author	Subject	For publication in	Remarks
RESEARCH IN SILVICS			
Forbes, R. D.	The virgin forests of the northern Alleghany Plateau	Ecology	
Hough, A. F.	A progress report on the Little Arnot plots	Journal of Forestry	
" "	The influence of soil type on the vegetation of a virgin forest on East Tionesta Creek	Soil Science, Journal of Forestry, or Ecology	
" "	Preliminary notes on the East Tionesta age study plots	Journal of Forestry, Pennsylvania Leaves, or Ecology	
" "	A type classification for the Alleghany Section territory	Journal of Forestry	
" "	Physical and pathological defects of second-growth beech-birch-maple stands in northwestern Pennsylvania	" " "	
Schnur, G. Luther	Comparisons between the volumes of trees of different species in one locality and between those of like species in different localities	" " "	
" "	Comparative growth increments in oak stands with and without brush removed	" " "	
Schnur, G. Luther and Simmons, E. M.	Some practical aids to stand improvement in loblolly pine	ECW or Maryland State publication	

Author	Subject	For publication in	Remarks
Simmons, E. M.	Basal area - ratio method of site classification in even-aged stands of loblolly pine in Maryland	Journal of Forestry	
Wood, O. M.	The factors affecting seed production, seed survival, seed germination, and seedling survival of oak in southern New Jersey	Ecology, or Journal of Forestry	
" "	The interception of precipitation in an oak-pine forest	Ecology	
" "	Relative number and vigor of sprouts following partial and clear cutting in sprout hardwood stands	Journal of Forestry	
" "	What part of the old root system is retained by the sprouts that follow cutting of the parent tree	" " "	

Author	Subject	For publication in	Remarks
RESEARCH IN FOREST PATHOLOGY			
Doak, K. D.	Identification of soil Hymenomycetes and Gasteromycetes by their cultural characters	Not decided	
" "	Absorption of water and mineral nutrients by mycorrhizal and non-mycorrhizal roots in pure culture	" "	
" "	The endotrophic mycorrhizal fungus Liriodendron Tulipifera L.	" "	
" "	Mycorrhizal relation of trees and shrubs in the Morris Arboretum	" "	
" "	Effects of mycorrhizae on growth of pitch pine (Pinus rigida) in pure culture	" "	
" "	The relationship of several non-mycorrhizal fungi and the mycorrhizal fungus Boletinus pictis to white pine (Pinus strobus)	" "	
Doak, K. D. and Fisher, P. L.	The relation of mycorrhizae and pseudomycorrhizae of coniferous nursery stock	Plant Physiology	Submitted early 1936
Doak, K. D. and Lisi, A. G.	Mycorrhiza formation in relation to parasitism by Armillaria mellea in pure culture	Not decided	
Doak, K. D. and Miller, P. R.	Effects of mineral nutrition on anthocyanin production by sorghum varieties	Plant Physiology	

Author	Subject	For publication in	Remarks
Jackson, L. W. R.	Dodder injury to black locust at the Mont Alto (Pa.) Nursery	Plant Disease Reporter	
" "	Cylindrocladium, a new nursery disease fungus	" " "	
" "	Damping-off isolation results from the Allegheny region nurseries	" " "	

TECHNICAL NOTES

Material is available and to a considerable extent has been prepared for use in a number of Technical Notes, to be sent in mimeographed form to organizations concerned with their subjects. A list of these Technical Notes, planned for 1936, follows:

No.	Author	Subject	Date (if released)
10	Hough, A. F.	Epicormic branching of Allegheny hardwoods	January 31, 1936
11	" "	Estimated area of forest land in three major forest regions of the Allegheny Forest Experiment Station's territory	Being mimeographed
	" "	Germination and survival on Little Arnot quadrats	
	" "	Growth in d.b.h. on Little Arnot plots	
	" "	Growth in height on Little Arnot plots	
	" "	Height growth of hemlock and hardwood seedlings in virgin stands	
	" "	Hemlock bark thickness curves	
	" "	Hemlock stump tapers	
	Wood, O. M.	Persistence of sprouts, with increasing age, in sprout hardwood stands	
	" "	Effect of overwood on the first-year survival and growth of oak seedlings	
	" "	Soil temperature in woods and open areas in the oak-pine type	
	" "	First-year losses after a fire may not represent total mortality	
	" "	Fire resistance of the principal tree species of southern New Jersey	

PART IV

FINANCES*

*The fiscal year 1935 (July 1, 1934 to June 30, 1935) being the last for which a complete statement of the Station's expenditures is available, the figures in the statement following are the same that appeared in the 1932-34 report.

Expenditures from Regular and Emergency Funds

of the

Allegheny Forest Experiment Station

Fiscal Year 1935

Research Projects and improvements	Regular Station Funds	Emergency Funds				Total Expenditures
		E.C.W.	N.I.R.A.	L.W.D.	Total	
Fp-3 Interplanting, New Jersey Coastal Plain	$ 665.37	$	$	$	$	$ 665.37
M-1 Birch-Beech-Maple Hemlock	10,277.57	5,889.26	2,139.72	230.65	8,259.63	18,537.20
M-3 Oak-Pine	4,643.97	2,165.65	2,081.83	819.00	5,066.48	9,710.45
ME-2 Oaks	4,163.49			232.80	232.80	4,396.29
ME-3 Oak-Pine	1,555.47	887.42	1,754.14		2,641.56	4,197.03
Pd Mycorrhiza	382.91			657.50	657.50	1,040.41
Special Studies	1,154.25			566.50	566.50	1,720.75
Improvements			6,745.06		6,745.06	6,745.06
Total	$22,843.03	$8,942.33	$12,720.75	$2,506.45	$24,169.53	$47.012.56

PART V

PROJECT RECORDS

RS - AL
M-1 (B.-B.-M.-Hem.)

March, 1936

PROJECT RECORD

Management, Birch-Beech-Maple-Hemlock

OBJECT: To determine the silvical characters of species, and silvicultural practices to be applied in producing desirable second-growth stands, of the birch-beech-maple-hemlock type in Pennsylvania and Maryland.

SCOPE: (1) Ecology of natural stands. Among the phases of this study are composition of type and subtypes; seed production, seed bed requirements, germination of seed and survival of seedlings; vegetative reproduction; extent and character of damage by various agencies; soil and climate as environmental factors; phenology. These studies are conducted on temporary and permanent sample plots in virgin and second-growth stands, and by greenhouse and laboratory experiments.
(2) Stand improvement cuttings. Cleanings, thinnings, and salvage cuttings in second-growth stands, studied on permanent sample plots.
(3) Reproduction cuttings, studied in second-growth stands on permanent sample plots.

STATUS (January 1, 1935):
Major project, begun in 1928. Working plan approved, but under revision to include broadened scope.
Ecology of natural stands. Ecological descriptions based on intensive strip cruises, have been made of the Heart's Content, Cook State Forest Park, and East Tionesta virgin forest tracts. In 1934 work began on collecting data on total age, growth, and location of trees on ten 1-acre plots in a portion of the East Tionesta tract about to be logged, as a basis for reconstructing its ecological history.

Ecological data were earlier obtained from 177 strip half-acre plots, in both virgin timber and second growth, widely distributed through the type in northern Pennsylvania. Data from a 10 per cent cruise of 1737 acres of second growth in the Kane Experimental Forest are also available. In 1932 15 permanent yield plots, and in '32-34 4 meteorological stations, were established on this Forest. The soils have been surveyed in detail. Permanent plots of 1/2-acre each, 4 in second growth and 1 in a cleared planting site, were fenced during 1934 to study the relationship of deer and rabbits to tree reproduction.

A description of the Heart's Content area was published in Ecology in 1930, and an article on diameter distributions in stands of northwestern Pennsylvania in the Journal of Forestry in 1932. Technical Note No. 1 of the Station deals with this project.

Stand improvement cuttings. Eight acres of permanent sample plots were established on Kane Forest in 1933 to study the value of thinnings and salvage cuttings in 40-year old stands.

Reproduction cuttings. The reaction of a 60-year old stand of mixed hardwoods, including some older growth, to reproduction cuttings is being studied on 4 permanent 1-acre sample plots established in 1928 and 1929 on Little Arnot Creek, Allegheny National Forest. The 5-year remeasurements were made in 1932.

ACCOMPLISHMENTS IN THE CALENDAR YEAR 1935:

Progress was made on a paper "The Virgin Forests of the Northern Allegheny Plateau."

Ecology of natural stands. The 1934 field data from the East Tionesta plots were analyzed and the age counts completed; additional field data and age sections were obtained. Articles on the East Tionesta area, and comparing Heart's Content and Cook Forest, were accepted for publication in the January, 1936, number of Ecology. A study of the cause of hemlock dying was made in the East Tionesta and Deer Lick Run virgin timber tracts. Data on stocking and composition of the Kane Experimental Forest were compiled. Storage and germination of black cherry seed were studied there.

Stand improvement cuttings. Records of the 8 acres of thinning plots were summarized and analysis begun.

Reproduction cuttings. Three Technical Notes on the Little Arnot plots (numbers 5, 6, and 7) were published, and the volume of the stands was computed. Records of reproduction and reserved trees were further analyzed.

PLANS FOR THE FISCAL YEAR 1937:

Ecology of natural stands. The paper on "The Virgin Forests of the Northern Allegheny Plateau" will be finished. Age data on the last four of the 1-acre plots established in 1934 will be completed, and analyzed. Studies of tree reproduction within and outside of the deer and rabbit-proof enclosures will be begun. Technical Note No. 9 on the dying of hemlock at Tionesta will be published in January.

Stand improvement cuttings. A paper on physical and other defects in second growth will be prepared. If time permits, a sample plot study of weedings in a 13-year old stand on the Kane Forest will be begun.

Reproduction cuttings. Several Technical Notes, and a progress report on selected phases of the Little Arnot cuttings, will be prepared for publication.

OTHER FACILITIES OR PERSONNEL NEEDED:

The early completion of an adequate series of permanent sample plots for stand improvement studies, including a range of ages and mixtures, is impossible without the addition of one technical man, of not less than junior forester rank, assigned year-long to this project. Work on the Tionesta sample plots cannot be economically completed without the use of a "dendrohelio-iconometer." Additional automatic recorders at two of the weather stations at Kane would be desirable, both from the standpoint of efficiency and safety of the observer.

PROPOSED DURATION OF PROJECT:

Tentative or partial information is obtained continually. Usable answers to some of the main questions encountered in this project may be expected within the next 5 or 10 years, but 40 or 50 years' observation is necessary to final answers.

ASSIGNMENT:

R. D. Forbes, A. F. Hough, and P. E. Ackerman

RS - AL
M-2 (Oaks)

April, 1936

PROJECT RECORD

Management, Oaks

OBJECT: To determine the silvical characters of species, and silvicultural practices to be applied in producing desirable second-growth stands, of the oak (oak-chestnut-yellow poplar) type in Delaware, Maryland, New Jersey, and Pennsylvania.

STATUS: A new project, to be outlined and undertaken in 1936.

ASSIGNMENT:
G. Luther Schnur

RS - AL
Pf-3 (Oak-Pine)

April, 1936

PROJECT RECORD

Fire Damage, Oak-Pine

OBJECT: To determine the immediate damage to the forest, and the ultimate degradation of the site, caused by forest fires in the oak-pine type of New Jersey, Delaware, and Maryland, as a basis for re-appraising existing fire protection methods and for determining justifiable expenditures for protection.

SCOPE: Damage and other effects of
(a) accidental fires
(b) "controlled burning"

These comprise:
(1) loss of tangible values, such as wood in the trees destroyed or injured, and reduced productive capacity of the site.

(2) loss of intangible values, such as water-holding capacity of litter and soil, and recreational appeal.

(3) effect on wildlife.

Methods employed in studying (1), above, include examination of records of past fires, and strip surveys to record resulting field conditions; establishment of permanent and temporary plots in some areas burned accidentally, and others under control; and biological, physical, and chemical analyses of the affected soils.

STATUS: Formerly on a territory-wide basis, but hitherto a minor project because of lack of personnel. Working plan under revision, to narrow scope to oak-pine type.
Only work undertaken to date has been an emergency study of damage by severe spring fires in southern New Jersey in 1930, conducted on 11 semi-permanent plots at Camp Ockanickon, and on the Lebanon and Bass River State Forests, New Jersey. These plots were re-examined in 1931 and '32.
Preliminary data from this study appear in the 1931 Annual Report of the Station. The same data were furnished to T. J. Starker for incorporation in articles in The Forest Worker (May 1932) and The Journal of Forestry (April 1934).

ACCOMPLISHMENTS IN THE CALENDAR YEAR 1935:
No work was done on this project in 1935.

PLANS FOR THE FISCAL YEAR 1937:

A plan will be prepared, jointly by the Station and the New Jersey Forest Service, for work on this project in southern New Jersey, and will be carried out on a cooperative basis, with CCC help. Experimental areas burned under control will be on State Forests.

PROPOSED DURATION OF PROJECT:

Some minor phases of this study may be completed within one year and the results published. Final results of the project can be expected in from five to ten years and will be published jointly by the New Jersey Department of Conservation and Development and the Station.

ASSIGNMENT:

O. M. Wood (Station); E. B. Moore (State of New Jersey). (Part time only)

RS - AL
M-3 (Oak-Pine)

March, 1936

PROJECT RECORD

Management, Oak-Pine

OBJECT: To determine the silvical characters of species, and silvicultural practices to be applied in producing desirable second-growth stands, of the oak-pine type of New Jersey, Delaware, and Maryland.

SCOPE: (1) Reproduction from seed of the principal species, including seed production, destruction of seed by various agencies, seed bed requirements, and seedling germination and survival, studied in natural woods and in artificially-prepared seed beds; also reproduction from sprouts, studied on sample plots.
(2) Root habits of principal species; including trees of all ages, and of sprout and seedling origin.
(3) Conversion of repeatedly-coppiced stands to mixed stands of high forest and coppice; includes all degrees of cutting to encourage seedling reproduction. Studied on permanent sample plots.

STATUS: (January 1, 1935)
Major project, begun in 1928. Working plan under revision. All work to date has been done on the Camp Ockanickon and Lebanon Experimental Forests in southern New Jersey in a sub-type characterized by pitch and shortleaf pines, and white, chestnut, and black oaks. Work has been largely confined to these species.
Reproduction.
(a) From seed. The seed crops of from 2 to 116 selected chestnut and white oaks have been recorded each year since 1928. Serious destruction of seed by animals compelled the use of screened and artificially-sown seed beds in all work. Since 1929 more than 60 such beds were sown to determine the effect under artificial control of such factors as soil acidity, nutrients and moisture, seed bed cover, shade, and competition, upon seed germination and seedling development of chestnut and other oaks, and pitch pine. Moisture intercepted by tree crowns, and thus prevented from reaching seed bed, was measured.
(b) From sprouts. Six 1/2-acre plots were established in 1930 in a 7-year old oak coppice stand at Camp Ockanickon and were treated as follows: 2 clear cut, 2 thinned by sprout clumps, and 2 untreated as controls. Size and number of sprouts recorded in 1934 on the 4 treated plots.
Part of the root system of a sprouting chestnut oak stump was hydraulically excavated and compared with that of an undisturbed tree having about the same basal area as the sprouting stump.
Root habits. In addition to the two trees mentioned immediately above, many oak seedlings were excavated and the development of their root systems in response to site conditions studied. The

root system of pitch pine was studied by excavating trees ranging in size from 1 year seedlings to trees 100 years old. Conversion to high forest. Two of the four permanent plots established at Camp Ockanickon in 1930 in the study of sprout reproduction will be used in the conversion study also. Changes in all conditions favorable to seedling reproduction will be recorded at 5-year intervals.

Four papers, two on seed productivity, one on seedbed temperatures, and one on root habits have appeared in the Journal of Forestry and other media.

ACCOMPLISHMENTS IN THE CALENDAR YEAR 1935:

(1) Reproduction. Phenological observations, including a study of seed production, were started for a number of the principal species on the Lebanon Forest. Seed production of two chestnut oaks at Camp Ockanickon was again measured. Survival and height growth of oak seedlings in 18 beds at the Lebanon were measured.
(2) No new root studies were made during 1935.
(3) Conversion to high forest. The first 5-year remeasurement of the four 1/2-acre plots at Camp Ockanickon was made. At the Lebanon a 16-plot Latin square was established, in which there are three replications of three different degrees of thinning and four control plots. The plots are 1/16-acre each with a 3/16-acre isolation strip, and situated in a 13-year old stand of oak and pine. Stem maps of all plots were made; the heights of all reserved trees were measured, and the cutting of marked trees was partly accomplished. The stand data were partly summarized. Eighty-nine 1/10-acre plots were measured on the Lebanon Experimental Forest and in CCC cuttings nearby as a guide to the selection and marking of the plots in the Latin square.
The working plan was revised to include cultural operations.
An article on the root development of pitch pine, with some comparative observations of shortleaf pine, appeared in the Journal of Agricultural Research for December 1, 1935.
An article on the effect of the forest on local climate appeared in the U. S. D. A. Yearbook for 1935.

PLANS FOR THE FISCAL YEAR 1937:

(1) Reproduction Studies.
(a) Measure and excavate, to obtain their dry weight, all seedlings remaining in the Camp Ockanickon beds.
(b) Record survival and height growth of oak seedlings at Lebanon.
(c) Measure seed production of 2 trees at Camp Ockanickon.
(d) As time permits, continue the phenological observations of numbered trees at the Lebanon forest.
(2) No further root studies are planned.
(3) Conversion to high forest.
(a) Check the actual cutting of the plots within the Latin

square against the cutting as marked on the stem maps.

(b) Start observations on changes in seed bed conditions and on reproduction in accordance with methods to be outlined in the revised working plan.

Proposed Publications.

1. The factors affecting seed production, seed survival, seed germination, and seedling survival of oak in southern New Jersey. Ecology or Journal of Forestry.
2. The interception of precipitation in an oak-pine forest. Ecology.
3. What part of old root system is retained by the sprouts that follow cutting of the parent tree? Journal of Forestry.
4. Persistence of sprouts, with increasing age, in sprout hardwood stands. Technical Note.
5. Relative number and vigor of sprouts following partial and clear cuttings in sprout hardwood stands. Short article for Journal of Forestry.
6. Effect of overwood on the first-year survival and growth of oak seedlings. Technical Note.
7. Soil temperature in woods and in open areas, Oak-Pine type. Technical Note.

PROPOSED DURATION OF PROJECT:

Some phases of the reproduction studies have been completed and the results will be presented in a paper during 1936. Completion of the remaining phases is anticipated within the next two years.

By 1940 the extent to which reproduction is established in the stand-conversion plots should indicate whether or not the primary aim of the cuttings made to encourage seedling reproduction has been attained. If the treatments prove successful, the working plan will probably need revision for further objectives, such as the release of the reproduction which will eventually replace the present inferior stands.

ASSIGNMENT:

O. M. Wood, K. Ogloblin, and temporary assistants. (Part time only.)

RS - AL
ME-2 (Oaks)

March, 1936

PROJECT RECORD

Mensuration, Oaks

OBJECT: To provide regional volume, stand, and yield tables and closely related information necessary for the management of the upland-oak forest types in the Eastern United States.

SCOPE: The measurement of from 100 to 300 trees of each of the important oaks and associated species for the computation of volume tables. The selection and measurement of 300 to 500 temporary sample plots, and the analysis of the data thus obtained for the computation of yield and stand tables.
The development of improved methods of analysis.

STATUS (January 1, 1935):

A major project. Working plan outlined by the Central States Station.

Contributions by the Allegheny Station:

Measurement of 57 yield plots	1927, 1928
Measurement and volume computation of 1600 trees .	1928
Cordwood converting factor study conducted at Westline, Pa.	1928
Volume tables for black cherry (computed at Station)	1929
Preliminary study of oak cordwood converting factors on the Black Rock Forest, Cornwall, N.Y.	1929
Establishment and measurement of 14 permanent yield plots in oak stands at Camp Ockanickon, N.J.	1929
Volume tables for 11 species (computed at Washington, D. C.)	1928-1930
Publication, as a Pennsylvania State Agricultural Experiment Station bulletin, of mine prop measurements, volume and weight tables, in cooperation with the Pennsylvania State College.	1931
Publication of results of Westline, Pa., cordwood converting factor study in the Journal of Forestry	1932
Stand and yield analyses completed and tables prepared for upland oak types	1933
Remeasurement of Camp Ockanickon yield plots . . .	1934

ACCOMPLISHMENTS IN THE CALENDAR YEAR 1935:

The manuscript entitled "Yield, stand, and volume tables for even-aged upland oak forests" was revised, following suggestions of the board of review, and resubmitted for publication early in 1935. Because lack of funds available for printing delays publication of this bulletin, the 45 volume tables were mimeographed and distributed to several organizations requesting them. Comparisons between the volumes of trees of different

species in one locality and between those of like species in different localities were completed.

PLANS FOR THE FISCAL YEAR 1937:

Since the main purpose of this project was attained with the preparation of the yield, stand, and volume tables, the project will be carried during the coming fiscal year as a minor one.

Brief papers will be prepared on the following subjects for the Journal of Forestry.

1. Volume comparisons as described under "Accomplishments in 1935"
2. Comparative increment on the permanent yield plots at Camp Ockanickon located in the "safety strip" from which brush was removed, and on adjacent plots where the trees continued to grow in competition with heavy underbrush.

PROPOSED DURATION OF PROJECT:

This project will come to a close during the present year, the periodic remeasurement of the permanent yield plots at Camp Ockanickon, N. J., being incorporated in the oak-pine management project (M-3).

ASSIGNMENT:

G. Luther Schnur, Miss Hazel Loose. (Part time only)

RS - AL
Fp-1 (Birch-Beech-Maple-Hemlock)

April, 1936

PROJECT RECORD

Forest Planting, Birch-Beech-Maple-Hemlock Type

OBJECT: To determine, by cooperative studies with the Lake States Forest Experiment Station and the Allegheny National Forest, the tree species and their climatic forms best adapted for forest planting on a variety of sites in northwestern Pennsylvania.

SCOPE: The planting, on a 4.5-acre reserved site on the Kane Experimental Forest, of Norway pine transplants raised by the Lake States Station from seed of various sources in their own region and the northeastern States, in order to select the climatic forms best suited to local conditions.
A cooperative study with the Allegheny National Forest of survival and growth of the chief species in several thousand acres of plantations, to determine their adaptability to various planting sites.

STATUS: A minor project. Working plans being prepared jointly with our cooperators.

Contributions by the Allegheny Station:
1933 Clearing and plowing, with CCC labor, of a 4.5-acre planting site to receive stock of Norway pine grown in the Cass Lake Nursery, Minnesota.
1934 Fencing of 1/2-acre in the 4.5-acre site against deer and rabbits, to permit evaluation of the effect of these biotic factors on the Norway pine seedlings. The planting stock promised for 1934 having been practically destroyed by white grubs, the planting cannot be done until new 2-1 stock shall become available in 1937. Forest Supervisor L. S. Gross proposed a survey of the plantations made since 1928 by the Allegheny National Forest and since 1909 by the Armstrong Forest Company. The plan provides for the assignment of a trained man of Junior Forester grade to make the survey under the technical direction of the Station.

ACCOMPLISHMENTS IN THE CALENDAR YEAR 1935:
No work was done on this project during 1935.

PLANS FOR THE FISCAL YEAR 1937:
Field work on the plantation survey will be completed in the summer of 1936 and the data obtained analyzed during the remainder of the year.
In the spring of 1937 5000 Norway pine 2-1 transplants from the Cass Lake Nursery, Minnesota, will be set out in the planting site on the Kane Experimental Forest. Records will be made of the height and the condition of each tree.

PROPOSED DURATION OF PROJECT:

The more important conclusions from the survey of plantations will be available early in 1937. Further analysis of the field data, to determine the reasons for failure or success in the plantations, may require a continuation of the study. Preliminary data from the Norway pine plantings on the Kane Experimental Forest will be available in from 3 to 5 years following the planting. Final results bearing on the success of the various climatic forms cannot be anticipated until 50 or more years after planting.

ASSIGNMENT:

A. F. Hough and P. E. Ackerman (Allegheny Forest Experiment Station. (Part time only)
J. E. Hetzel (Allegheny National Forest). (Part time only)

RS - AL
ME - 3 (Oak-Pine)

March, 1936

PROJECT RECORD

Mensuration, Oak-Pine

OBJECT: To accumulate data on the mortality and growth of natural and thinned stands of old-field loblolly pine with the object of (a) facilitating management of the species at the northern limit of its range, and (b) determining analytically whether growth and stand development follow certain trends which indicate the existence of general laws.

SCOPE: The re-measurement every 5 years of the permanent sample plots established in 1906 in Worcester County, Maryland, and the computation, tabulation, and punching on cards of the periodic growth data.
Analyses of data necessary for answering basic silvicultural questions as they arise.

STATUS (January 1, 1935):
Major project. Begun in 1906 and assigned to the Allegheny Station in 1927 without a formal working plan.

58 permanent sample plots established and measured..... 1906
55 " " " remeasured..... 1910
55 " " " " 1915
48 " " " " 1920
Publication of "Loblolly pine in Maryland" by Maryland Forest Service..... 1923
29 permanent sample plots remeasured..... 1926
24 " " " " 1930
Cumulative office record sheets set up..... 1931
Volume tables prepared from Maryland Forest Service measurements.....1932, 1933
Diameter distribution study. Results and description of methods published in Journal of Agricultural Research.....1933, 1934
Records tabulated and placed on punch cards for future analyses..... 1934
Study of stand density and basal area in relation to growth..... 1934

ACCOMPLISHMENTS IN THE CALENDAR YEAR 1935:

A manuscript entitled "Effect of stand density and basal area on mortality and growth of loblolly pine, with special application to thinnings" was completed, and submitted for publication in the Journal of Agricultural Research. Some of the permanent sample plots in Worcester County, Maryland were remeasured for the seventh time. A paper entitled "Basal area-ratio method of site classification in even-aged stands of loblolly pine in Maryland", was prepared for publication.

PLANS FOR THE FISCAL YEAR 1937:

Because the Station allotment no longer permits the assignment of anyone to this project, and because its scope is so wide that no definite goal can at present be set, except for minor phases, this project is designated a minor one for the time being.

In the immediate future it is planned to:

1. Prepare a working plan.
2. Complete remeasurement of the remaining permanent sample plots.
3. Assemble the newly obtained data from these plots into a form suitable for punching on cards in the Washington office.
4. Outline, for publication, a practicable method of applying to stand improvement work the thinning information from earlier studies.

OTHER FACILITIES OR PERSONNEL NEEDED:

Lack of funds seriously handicaps the analyses of these data. Many problems in mensuration and sample plot technique could be solved, and considerable aid to forest management derived, from these long-term records if an experienced mensurationist, with clerical assistance, could be assigned to study them.

PROPOSED DURATION OF PROJECT:

For the reasons stated in the preceding paragraph the duration of this project must be considered to be indefinite.

ASSIGNMENT:

G. Luther Schnur, O. M. Wood, Miss Hazel Loose. (Part time only)

RS - AL
Fp - 3 (Oak-Pine)

March, 1936

PROJECT RECORD

Interplanting, New Jersey Coastal Plain

OBJECT: To determine the silvicultural and economic possibilities of supplementing the present inadequate stocking of Coastal Plain stands in southern New Jersey by interplanting.

SCOPE: The interplanting of coniferous species in sprout hardwood stands of varying composition, age, and density, on upland soils.

STATUS: (January 1, 1935)
A minor project. Working plan approved.
During the years 1930 to 1933 inclusive over 10,000 seedlings of Pinus strobus, L., Pinus resinosa Sol., Pinus Banksiana Lamb., Pinus taeda L., Pinus echinata Mill., Pinus rigida, Mill., and Pinus virginiana Mill., were interplanted on 40 acres of sprout hardwood land, cut and burned over within 10 years, at the Camp Ockanickon Experimental Forest in Burlington County, New Jersey. The planting was done by means of the slit method. The number of seedlings planted varied from 125 to 550 per acre. For comparative purposes seedlings were also planted on land cleared of all hardwood growth and interplanted in hardwood stands that had been thinned. The stock used was 1, 2, and 3 years old. That planted in 1933 was grown from seed collected locally.

Each seedling is conspicuously marked with a numbered stake, and an annual record has been kept of its height and condition.

ACCOMPLISHMENTS IN THE CALENDAR YEAR 1935:

No additional field work was done during 1935. A manuscript summarizing the results of the planting done up to this time was submitted for criticism. Technical Note No. 4 of the Station deals with this project.

PLANS FOR THE FISCAL YEAR 1937:

No additional field work is planned for 1936-7. The paper summarizing results through 1934 will be revised for publication.

PROPOSED DURATION OF PROJECT:

The main objective of experiment should be attained by 1945. The development of the interplanted trees will be followed at 5-year intervals, dated from the last examination made in 1934. Results will be published periodically as they become available.

ASSIGNMENT:
O. M. Wood and field assistants. (Part time only)

B. P. I.
Project 6P (Mycorrhiza) April 1936

PROJECT RECORD

Mycorrhiza

OBJECT: To determine the significance of mycorrhizae to growth of important forest species and their relation to current and future forest practices.

SCOPE: The attainment of the above object is possible only after answers have been found to a number of questions, each of which practically constitutes an individual sub-project of research. These sub-projects deal with the following phases of the major problem:

1. The extent of the mycorrhizal habit of forest tree species, especially the more important in the Allegheny Region, and with emphasis on those grown in forest nurseries. This includes establishment of the occurrence of mycorrhizal relations in the widely planted exotic tree species which show decadence at earlier stages of development than expected.
2. The nature of the association of fungi with roots morphologically.
3. Determination of the species of fungi involved in mycorrhiza formation in nurseries, plantations, and stands, and the cultural proof thereof.
4. The relative importance of mycorrhizae and pseudomycorrhizae under different nursery conditions.
5. Establishment of the factors influencing root reaction with mycorrhizal fungi under controlled conditions.
6. The influence of mycorrhizae on absorption of inorganic and organic compounds and water, and on growth.
7. The interaction of parasitic and non-parasitic non-mycorrhizal fungi, and mycorrhizal fungi, on growth under controlled conditions.
8. Establishment of the various physiologic forms of certain fungus species and their mycorrhizal relations.
9. Classification of sterile mycelium mycorrhizal fungi, involving species not described before.
10. Establishment of mycorrhizal host relations by sporophore production of certain hymenomycetes and gasteromycetes in close association with certain tree species.
11. The development of methods suitable for isolating, handling, and classifying mycorrhizal fungi, and of methods for determining their effects on growth and their relations to nursery, plantation, and other forest management practices.

STATUS: (January 1, 1935)
Project begun November 1, 1930. Original working plan revised to include phases of study made possible by improved methods and developments not suspected when project started.

Preliminary surveys. Occurrence and prevalence of mycorrhizae and pseudomycorrhizae for the important forest species was determined. Species grown in nurseries for planting were given more attention after the first year. Root collections obtained served as a basis for later determination of the morphological characteristics of the mycorrhizae present. Isolations of suspected mycorrhizal fungi from sporophores were used later for testing with seedlings of various tree species in sterile culture.
Sterile culture studies. Under sterile culture conditions, 31 combinations of fungus and host species were proven mycorrhizal. Proof was obtained that the forms of nitrogen supplied were determining factors in the effects of mycorrhizal fungi on growth of conifer seedlings during the first year. Improvement in methods made possible more extensive subsequent growth studies.
Soil inoculation. Various substrata for pure cultures proved inadequate in attempts to introduce proven mycorrhizal fungi into soil in two nurseries.
Publications appeared as follows:

"Mycorrhizal and other features of the root systems of Pinus", Journal of the Arnold Arboretum;
"Mycorrhizae in relation to shade trees", Proceedings of the American Shade Tree Conference;
"Fungi that produce ectotrophic mycorrhizae of conifers", Phytopathology;
"Cortical parasitism of conifer seedling roots in pure culture by mycorrhizal and non-mycorrhizal fungi", Phytopathology.

ACCOMPLISHMENTS IN THE CALENDAR YEAR 1935:

Progress was made on all continuous phases of the project. The working plan was revised and certain new phases of experimental work were completed:
Isolation of fungi and synthesis studies. 22 species of suspected mycorrhizal fungi not cultured previously were added to the permanent culture collection and 27 new combinations of hosts and fungi gave mycorrhizae in sterile culture synthesis.
Direct Isolations. Several fungi obtained by direct isolation from mycorrhizae of nursery seedlings were identified by comparison of the mycelial characters with authentic sporophore cultures. Improvements in sterilization methods made these isolations possible.
Factors influencing mycorrhizal reaction. The relative stability of the mycorrhizal reaction of Pinus strobus and P. rigida to certain fungi was demonstrated by alteration of water supply, aeration, carbohydrate supply and inorganic nutrients. Results of this are included in a manuscript dealing with synthesis of mycorrhizae under sterile culture conditions.
Growth and absorption relations. The action of mycorrhizae, produced by Boletinus pictis on Pinus rigida in sterile culture, in decreasing growth when inorganic nitrogen (nitrate and ammonium) was supplied and increasing growth when organic nitrogen (nucleic acid) was substituted, indicated that the effects are dependent on nutrient balance. Under controlled conditions, ectotrophic mycorrhizae of pine seedlings were proven a hindrance to absorption of water and dissolved inorganic salts by the use of vital dyes.

Secondary parasitism of mycorrhizae. Two species of Rhizopogon were proven parasites of the ectotrophic mycorrhizae of Pinus taeda and P. echinata by the formation of secondary mantles under sterile conditions. A manuscript dealing with this was prepared for publication.

Publications appeared as follows:
"Mycorrhizal and pseudomycorrhizal infections of pine roots during first year's growth", Phytopathology;
"The fixing and staining of Liriodendron Tulipifera L. root tips and their mycorrhizal fungus", Stain Technology.

PLANS FOR THE FISCAL YEAR 1937:

Manuscripts previously prepared and dealing with continuous phases of the project will be revised. Results of other completed work will be prepared for publication. Descriptions of certain methods proven dependable will be issued as technical notes.

Soil inoculation. Previously tested culture methods will be used in preliminary attempts to introduce known mycorrhizal fungi into soils in the field, and to determine their action in forming mycorrhizae under various conditions. Soils least likely to contain these fungi have been selected.

Factors influencing mycorrhizal reaction. This is a continuation of studies done previously in the laboratory and the field, revised to include a study of mycorrhizal reactions in plantings showing premature decadence of certain species.

OTHER FACILITIES AND PERSONNEL NEEDED:

All experimental work in progress and maintenance of materials requiring continuous attention for future use can be handled with present facilities and personnel. Continuation of extensive field work for obtaining fungi in culture and for soil inoculation and experimental field studies will require additional personnel with training and experience in forest pathology and soil microbiology.

PROPOSED DURATION OF PROJECT:

Continuous. Certain phases of the project are completed and the results will be published at regular intervals; others are continuous, to be reported at irregular times. The most significant phases, involving physiology and soils interactions, will be emphasized only as methods, facilities, and personnel shall become available.

ASSIGNMENT:

K. D. Doak

B. P. I.
Project 2P

April 1936

PROJECT RECORD

Nursery Diseases

OBJECT: To study the diseases of nursery stock, their causes, effect on production, and the development of control measures.

SCOPE: The project, covering all of the State and Federal nurseries in the region, and including a considerable amount of cooperative work with nurseries outside the region, comprises:

1. The testing of the efficacy of certain soil disinfectants against damping off and root rot diseases. Major emphasis is given to acidifying agents.
2. The development of new organic soil disinfectants for use in cases where soil acidification is ineffective.
3. A study of the factors involved in the efficacy of aluminum sulfate and sulphuric acid.
4. The cultural study of the fungous parasites that cause the more important seedling diseases.
5. Studies of the causes of root rot of conifer seedlings.
6. Cooperation with all nurseries desiring control measures.
7. A special study of the effect of formaldehyde on the soil when it is used as a disinfectant.

STATUS (January 1, 1935):

The branch office's principal project, begun in 1930. Hitherto a large part of the work has dealt with the extending of service and the making of recommendations to the various cooperating nurseries on controlling or preventing diseases.

ACCOMPLISHMENTS IN THE CALENDAR YEAR 1935:

1. Development of a laboratory method for determining the rate of application for acidifying agents to nursery soils. It is known as the acid requirement method.
2. The determination of the acid requirement, buffer capacity, and colloid percentages for nearly 45 nurseries throughout the United States.
3. A disease control experiment at the Pennsylvania state nursery at Mont Alto, comprising over 200 small plot tests of a large number of disinfectants.
4. A disease control experiment at Parsons, West Virginia, consisting of nearly 200 small plot tests.
5. A disease control experiment at the New Jersey state nursery at Washington Crossing, comprising 200 small plot tests.
6. A culture study of the damping off and root rot fungi in the regional nurseries. Several thousand isolations were made and several new fungous parasites were discovered.
7. Preliminary results were obtained on the effect of soil acidification by aluminum sulphate and sulphuric acid on the growth of the roots of conifer seedlings.

8. Preliminary results were obtained from a study of the nature of the root rots of conifer seedlings.

PLANS FOR THE FISCAL YEAR 1937:

1. Continue the laboratory studies on the root rots of conifer seedlings.
2. Continue the work on service recommendations for the several nurseries in the region.
3. Continue the field tests on the efficacy of certain soil treatments, especially formalin and the acidifying agents.
4. Preparation of a number of papers dealing with nursery diseases and control measures.

PROPOSED DURATION OF PROJECT:

Although solution of the various problems coming up under this project signify each time the ending of some phase of it, the rise of new ones and the continuous appearance of diseases unknown before make this project necessarily a permanent one.

ASSIGNMENT:

L. W. R. Jackson

B. P. I.
Project 1P2

April 1936

PROJECT RECORD

Disease Survey

OBJECT: To record observations on the distribution and prevalence of forest tree diseases, including shade trees, and attend to all related general inquiries.

SCOPE: The project covers the work on all tree diseases, including those in plantations, but excluding those in nurseries. Disease cases requiring intensive investigation and study are set up as special sub-projects. Plantation diseases and surveys constitute a definite sub-division of it.

STATUS. (January 1, 1935):

A major project since the establishment of the branch office. The following important disease cases were among the large number of general inquiries for which observations have been made and reports filed:

1. Austrian pine twig blight
2. Blue spruce resinosis
3. Plane-tree disease
4. Brooming disease of black locust
5. A number of cases of plantation dying
6. Ailanthus wilt
7. Oak twig blight prevalent in the forests of the Allegheny region
8. Himalayan pine dying
9. Resinosis diseases of conifers in plantations
10. Pine twig canker diseases
11. Strumella canker
12. Nectria canker
13. Drought injury
14. Winter injury

The disease cases which required the setting up of special research projects were the following:

1. Norway pine dying in a plantation on the Baltimore watershed.
2. Pine dying in plantations on a private estate near Reading, Pennsylvania.
3. Plane-tree disease in the Philadelphia area.
4. Pine dying in the plantations on the watershed at York, Pennsylvania.

ACCOMPLISHMENTS FOR THE CALENDAR YEAR 1935:

1. Preliminary diagnosis of the pine dying on the watershed at York, Pennsylvania.
2. Preliminary diagnosis of the pine dying case on the Baltimore watershed.
3. A further investigation of the plane-tree disease prevalent in the Philadelphia area.
4. A large number of observations on general tree diseases.

PLANS FOR THE FISCAL YEAR 1937:

1. Continue the collection of disease survey notes.
2. Investigate the dying of pine on the Baltimore watershed.
3. Continue the observations of the dying of Norway pine on the York watershed.
4. Attempt to coordinate the work of the disease survey agencies in the region.

PROPOSED DURATION OF PROJECT:

Dealing with diseases and rendering of service in the areas affected, this project obviously is continuous.

ASSIGNMENT:

L. W. R. Jackson